MACHINE AND TOOL ENGINEERING

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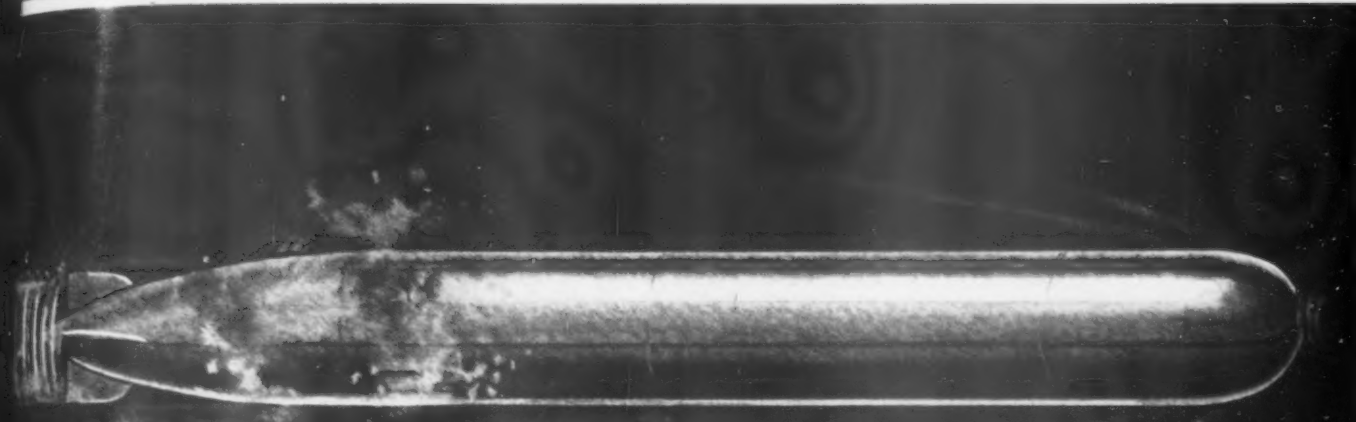
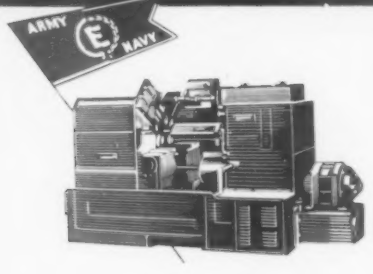
The TOOL ENGINEER

Official Publication of
American Society of Tool Engineers

JUNE, 1943



The Heart of a "Tin Fish"



● The accuracy of a torpedo depends upon the accuracy of the machines which turn out the hundreds of small parts in its mechanism.

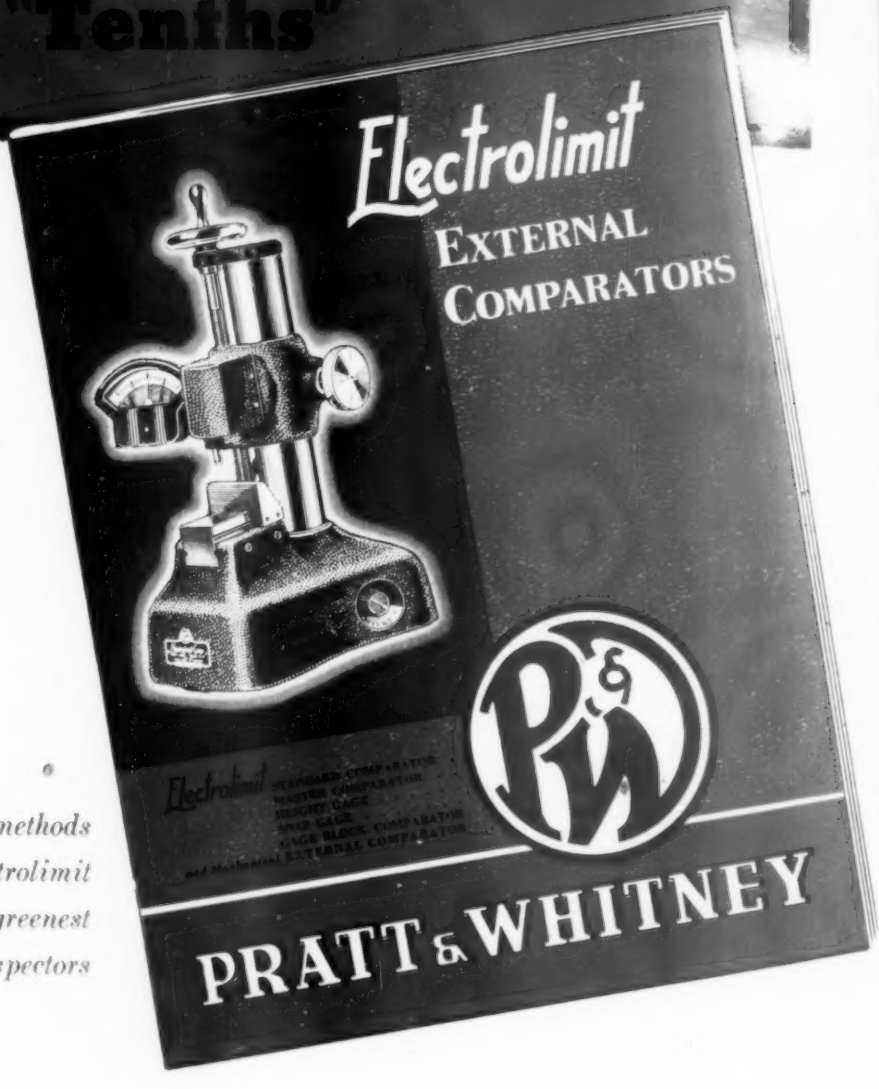
These parts, by the millions, are the product of New Britain Automatics — a guarantee that essential accuracy can be depended on to send our tin fishes straight to their marks.

NEW BRITAIN AUTOMATICS

NEW BRITAIN-GRIDLEY • MACHINE DIVISION
The New Britain Machine Co. • New Britain, Conn.

PUBLISHED BY THE BRAMSON PUBLISHING COMPANY

Even *Green* Operators can Inspect *Rapidly* ...to "Tenths"



This New Bulletin Tells How

Accurate, high-speed gaging methods made possible by P&W Electrolimit Comparators actually turn the greenest operators into competent inspectors almost overnight.

If P&W Comparators did no more than that, they'd still be valuable additions to the equipment of any precision metalworking plant today. But they do *far* more: they eliminate "feel," pass okay parts that might be rejected by less positive methods, check parts *at the machine* with laboratory accuracy.

INVESTIGATE the speed-up possibilities of Pratt & Whitney Electrolimit Comparators — this new bulletin tells all.

COMPANY EXECUTIVES: Your free copy will be sent promptly if you'll request it on your company letterhead.

PRATT & WHITNEY
Division Niles-Bement-Pond Company
WEST HARTFORD • CONNECTICUT

CARBIDE TOOL

Service Beyond the Sale!

TO HELP FURTHER INCREASE WAR PRODUCTION

★ CARBIDE TOOL TRAINING COURSE

To help carbide users in war industries speed the training of new men, apprentices, and those being converted to carbide tool use in the metal working trades, Carboloy Company operates an instruction course at its Detroit plant for the training of carbide users' key men. These men receive one week's training in the fundamentals of design, brazing, application and maintenance of carbide tools, through actual shop practice, discussion periods, and training film showings. The men return to their own plants with a basic knowledge of carbide practice—and recommended procedure for training their own men, assisted, when desired, by our field engineers.

During the two years in which this training course has operated, carbide users in 39 states and 3 allied countries have received this training. The course is operated without charge as a service to war industries. A similar service is available to cartridge case die users—to instruct in the finishing and servicing of carbide dies for drawing cartridge cases.

★ FIELD SERVICE

Since the day cemented carbide was first introduced—as a new, strange, "revolutionary" tool material—Carboloy has maintained a large, active staff of experienced field engineers to assist users in all phases of carbide tool practice. As an example of the type of service these men render, in one year alone they trained more than 5,000 men in users' plants in the correct methods of rapid carbide tool grinding.

★ SPECIALLY DEVELOPED GRINDING EQUIPMENT

Special carbide grinding equipment developed by Carboloy Company in cooperation with machine builders, plus special rapid grinding technique, conserves carbides, reduces down time on thousands of vital war jobs. (Cat. GT-141.)

★ NEW CHIP BREAKER GRINDER

New!—Improved type of grinder for grinding chip breakers in carbide steel cutting tools, including roller turner tools. Sturdier, larger table, high and low speed table travel. Also adaptable to grinding precision boring tools and flat form tools. (Left.)

★ TRAINING FILMS

To help in the gigantic task placed upon industry and government, of training new thousands of workers, a set of six carbide training films—as described below—was made available by Carboloy to industry last fall—to provide detailed training in all phases of carbide tool use. (Booklet GT-151.)

Film—"WHAT IS CEMENTED CARBIDE?"
Film—"DESIGNING CARBOLOY TOOLS"
Film—"BRAZING CARBOLOY TOOLS"
Film—"CHIP BREAKERS"
Film—"GRINDING CARBOLOY TOOLS"
Film—"PUTTING CARBOLOY TOOLS TO WORK"

These six films are available at approximate print cost

★ RESEARCH AND DEVELOPMENT

A special committee on research and development functions at Carboloy to constantly improve present methods and develop new methods, new materials for the future. The work of the men on this committee—headed by Dr. Zay Jeffries, metallurgist and Chairman of the Board of Directors of Carboloy Company—has resulted in many outstanding contributions now helping to further speed war production through carbide usage. This committee will continue its efforts to advance the art in the days of peace as well.

★ ENGINEERING ARTICLES IN THE TECHNICAL PRESS

Through frequent articles in technical magazines Carboloy engineers disseminate information on current phases of carbide use important to war industries. Milling with carbides, machining cast armor plate, renewing worn high speed steel tools, are a few of the many subjects covered in the past 12 months.

★ INSTRUCTIONAL LITERATURE

Each year Carboloy publishes comprehensive engineering bulletins covering latest carbide practice. Current booklets include D-113-R—finishing and servicing cartridge case dies—GT-133—carbide tool manual of design, brazing, grinding, application—GT-127—grinding carbide end cutting tools.

CARBOLOY COMPANY, INC., 11145 E. 8 MILE AVE., DETROIT, MICHIGAN

Sole makers of the Carboloy brand of cemented carbides

Birmingham, Ala. • Chicago • Cleveland • Los Angeles • Newark • Philadelphia • Pittsburgh • Seattle

Canadian Distributor: Canadian General Electric Co., Ltd., Toronto, Canada

CARBOLOY CEMENTED CARBIDES

TRADEMARK

TRADEMARK

OLS • DIES • DRESSERS • MASONRY DRILLS • WEAR RESISTANT PARTS

LIBBY HEAVY DUTY TURRET LATHE PERFORMS 10 Operations ON SOLID STEEL FORGING

... including

BORING, REAMING, TURNING,
SPOT-FACING, CHAMFERING, AND THREADING

JOB DATA

MACHINE—Libby 4H Heavy Duty Turret Lathe.
PART—Airplane Landing Strut.
MATERIAL—Solid Steel Forging.
HOLDING METHOD—3-Jaw Chuck—Steady Rest.
FLOOR-TO-FLOOR TIME—2½ Hours.

OPERATIONS:

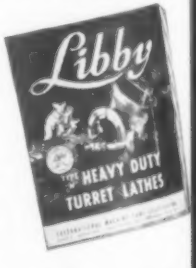
1st—Bore 6.345" x 6" deep, −.005"-+.002" on diameter.
2nd—Bore 5.970" x 25" deep, −.005"-+.000" on diameter.
3rd—Bore 3 sizes, 3⅛" dia., 5.970", 6.244" thread diameter.
4th—Finish bore 3⅛" dia., 5.970", 6.244" thread diameter.
5th—Ream 3⅛" diameter, 27" from end.
6th—Spot-face shoulder 25 15/16" deep from end, without support.

CROSS SLIDE OPERATIONS:

1—Turn O.D. for thread.
2—Thread relief on O.D.
3—Chamfer both edges.
4—Thread inside, 16 pitch.

● On this airplane landing strut, machined from a solid steel forging, a Libby Heavy Duty Turret Lathe performs a variety of ten operations in a total time of 2½ hours, floor-to-floor. Four boring operations are performed on holes up to 6.345" x 6" deep with cemented carbide tools. Subsequent operations include; reaming a 3⅛" diameter, spot-facing shoulder, and, on the cross slide, turning O.D. for thread, threading relief on O.D., chamfering both edges, and threading the inside.

This installation is typical of the way Libby Heavy Duty Lathes are being used for a wide variety of heavy duty work as well as the regular run of turret lathe work. If your turret lathe work is large or unwieldy, consult our engineers for their recommendations—there is no obligation.



FREE BOOKLET

This booklet contains additional information concerning other valuable features of the Libby Heavy Duty Turret Lathes...write to Libby Division, 1130 W. 21st Street, Indianapolis, Indiana.

INTERNATIONAL MACHINE TOOL CORPORATION

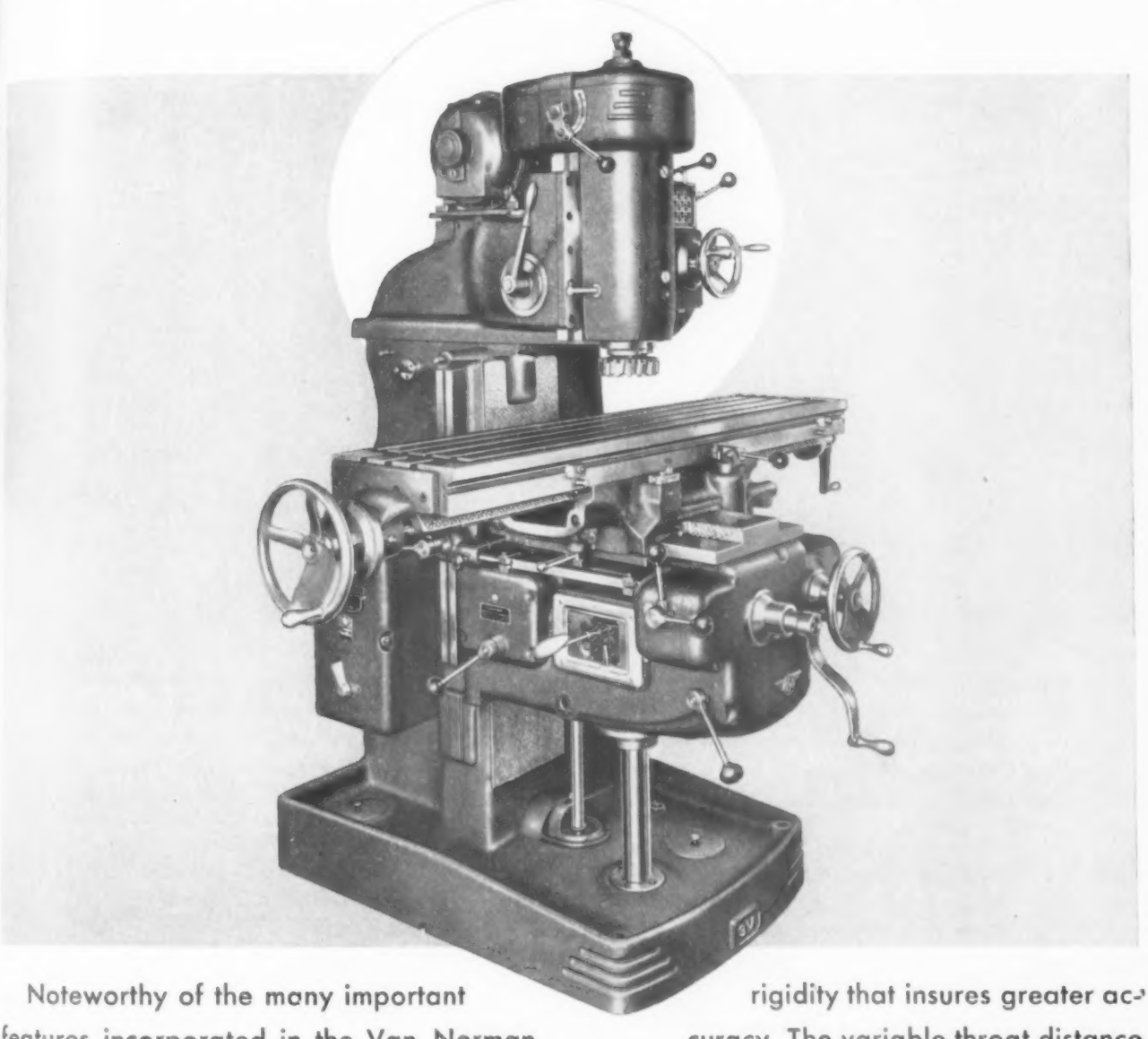
LIBBY DIVISION, INDIANAPOLIS, INDIANA · FOSTER DIVISION, ELKHART, INDIANA

MAIN OFFICE AT ELKHART, INDIANA

FOSTER FASTERMATICS · LIBBY HEAVY DUTY TURRET LATHES · STANDARD TOOLS
SUPERFINISHING MACHINES · BARKER CHUCKS · UNIVERSAL RAM TYPE TURRET LATHES

Adjustable Ram and Spindle Assembly Increases Your Work Range

ON VAN NORMAN 3V VERTICAL MILLERS



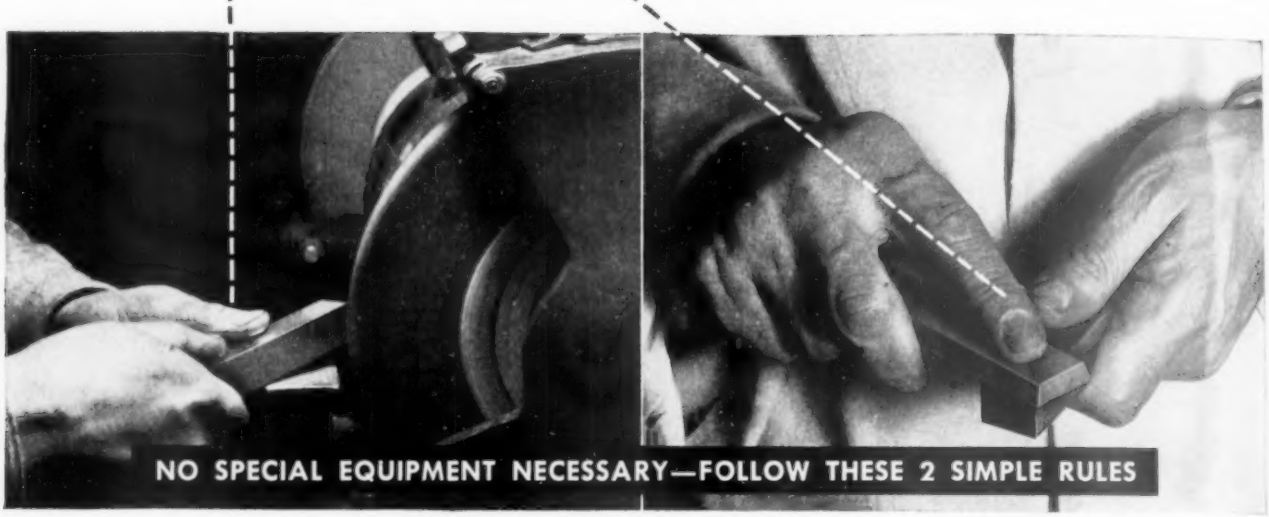
Noteworthy of the many important features incorporated in the Van Norman 3V Miller is the adjustable vertical spindle, mounted on a sliding ram. This sliding ram permits the throat distance to be varied so that the spindle can be more closely coupled to the column... which means maximum rigidity that insures greater accuracy. The variable throat distance also increases the range of set-ups and work that can be handled on this machine. Also the front and rear directional controls of power feeds for table, knee and saddle as well as rapid traverse provide ease of operation.

Van Norman Milling Machines

VAN NORMAN MACHINE TOOL CO., SPRINGFIELD, MASS.

LOOK HOW EASY IT IS TO SHARPEN

TANTUNG TOOLS!



#1 Use slightly less clearance angles than high-speed steel tools require. For off-hand grinding, a 46-grain aluminum oxide, abrasive, vitrified bonded wheel is best—60-grain if a better finish is desired. Straight wheel for roughing. Cup wheel for finish.

#2 Hand hone after grinding, to give the cutting edge even longer life. And when grinding, take it easy. "Light pressure" is the word with Tantung tools. Move edge back and forth across wheel face. Re-sharpen as soon as tool begins to show dullness or wear.

NEVER *Use Diamond Wheels . . .* NEVER *Quench in Water!*

Yes, sir! It's no job at all to sharpen Tantung tools. 'Most anybody can do it. So what's keeping *you* from increasing your production, cutting down lost time, *saving money* with Tantung?

What Is TANTUNG?

Tantung is the *only* cast, non-ferrous alloy containing tantalum carbide. It wears from *2 to 25 times* as long as high-speed steel—has a red hardness far above that of any steel. Tantung is strong and tough, and has a self-lubricating action that minimizes chip wear or "cratering." Tantung tools cut shutdowns, do a faster, cleaner, more uniform job. Specify Tantung tools for all work not suitable for carbides.

Joe Bloakes, the foreman said,
Was one of the world's biggest fools;
But even poor Joe—
not a brain in his head—
Could sharpen up Tantung tools!

VASCOLOY RAMET CORPORATION

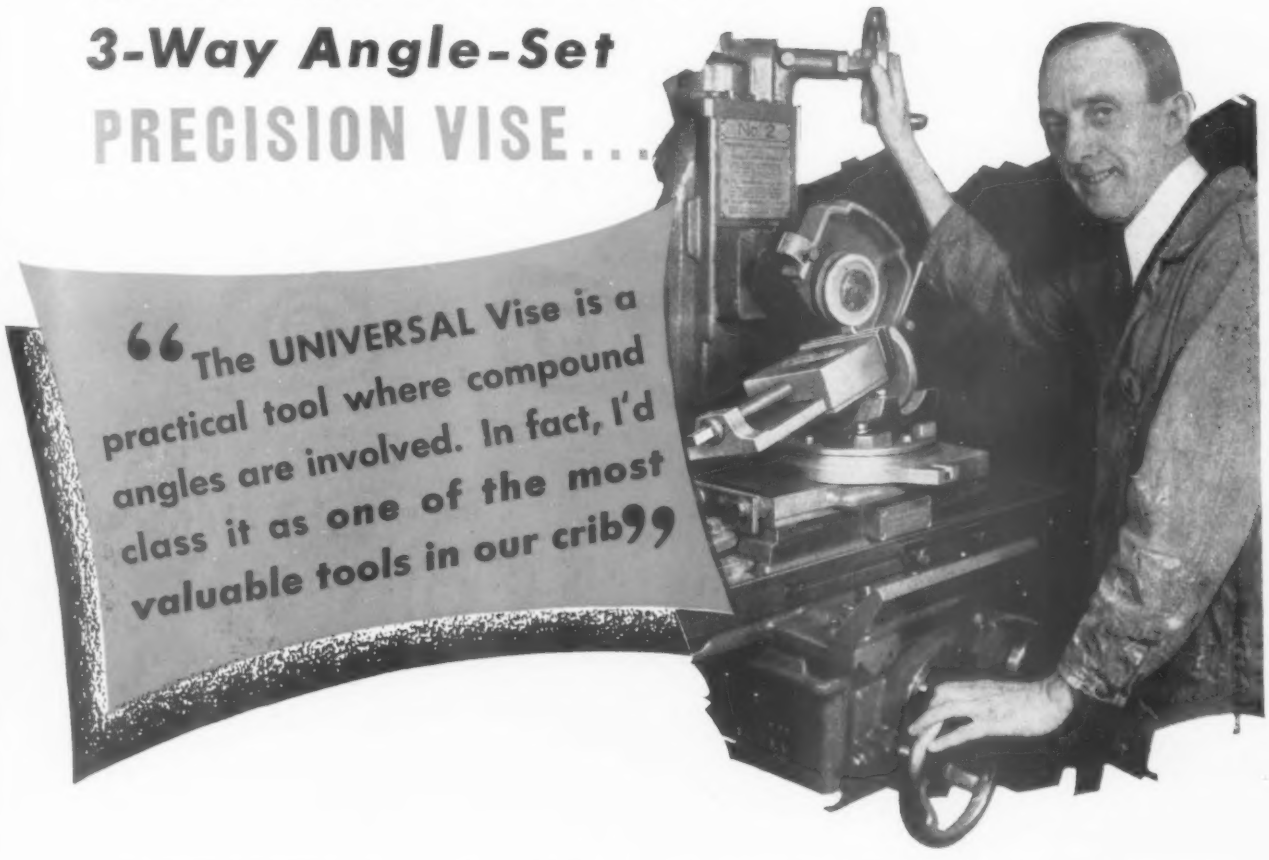
NORTH CHICAGO, ILLINOIS · DISTRICT SALES AND SERVICE IN PRINCIPAL CITIES
IN CANADA: CARBIDE TOOL AND DIE COMPANY, LTD., HAMILTON, ONTARIO

4319

Here's what a veteran at

FAIRCHILD AIRCRAFT SAYS

about the UNIVERSAL *3-Way Angle-Set* PRECISION VISE...



"The UNIVERSAL Vise is a practical tool where compound angles are involved. In fact, I'd class it as one of the most valuable tools in our crib"

CHARLES LEIGHTON knows plenty about angle machining. He's a veteran tool-room machinist with the Ranger Engine Division of Fairchild Engine and Aircraft Corporation at Farmingdale, Long Island. What he says is based on long experience with angle machining jobs, both in the tool room, and on the production line.

Wherever you find "UNIVERSAL" Vises on the job you'll find this same enthusiastic response. For these tools are doing a really sensational job on simple and compound angle machining of all kinds. Three-way adjustment — 360° rotation on base, 90° tilting on upper and lower cradles — enables UNIVERSALS to convert your standard machine tools into universals themselves, capable of machining at any angle or *combination of angles!*

You can get immediate delivery on your "UNIVERSALS" by sending us your order today, accompanied by priority rating. Price is only $160, FOB Parma, Michigan. Terms: 2%, 10 days; net, 30 days.

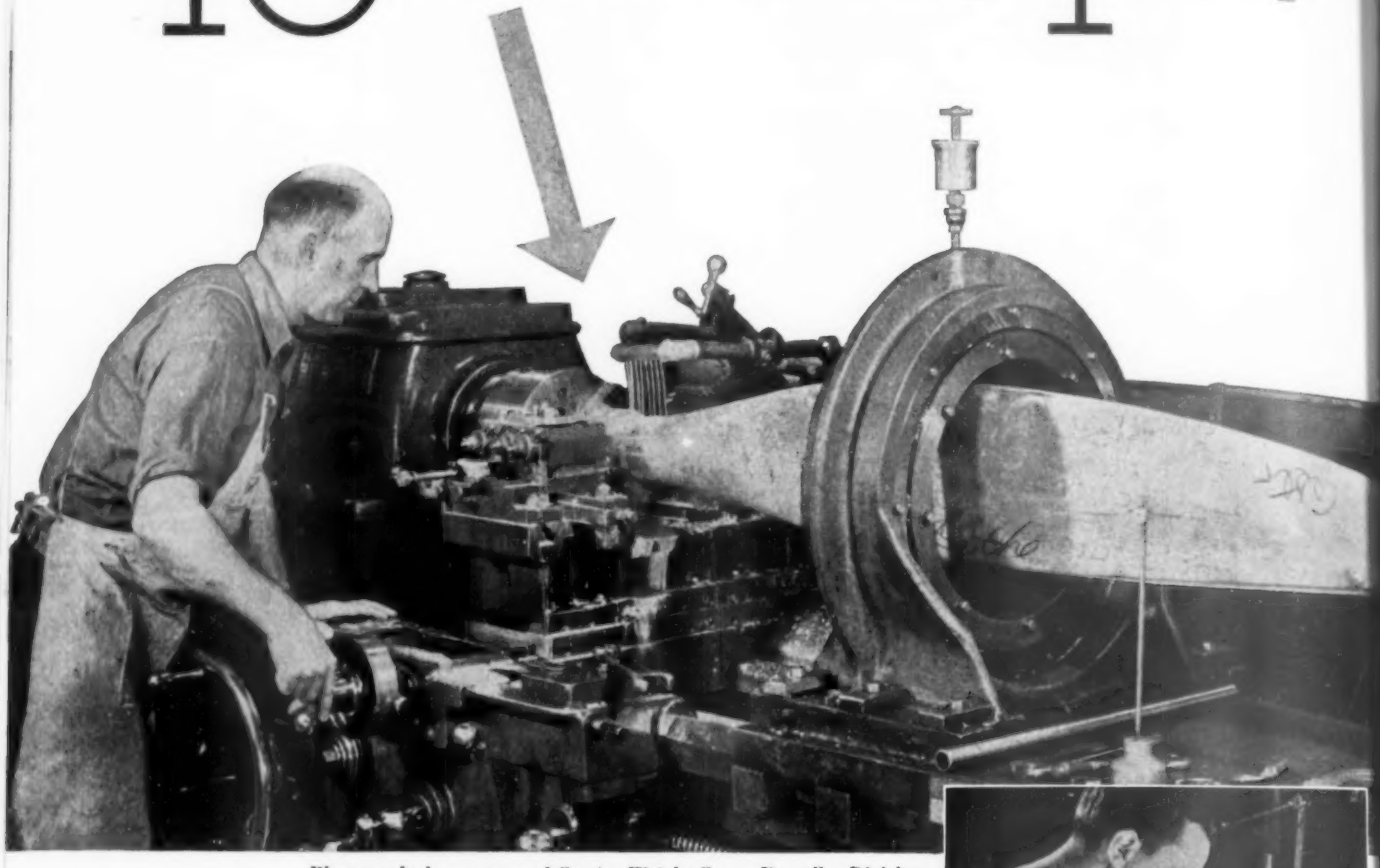
Write Today For 12 Drawings Showing Actual Production Uses

12 production set-ups in accurately detailed drawings. These sketches have stimulated men in hundreds of plants to think of new and better ways to handle angle machining jobs. Scores have been requested by operating executives for distribution to foremen and supervisors. Get your set FREE and without obligation, by requesting them on your business letterhead. Write at once, today, to

UNIVERSAL VISE & TOOL COMPANY

131 Main Street **Parma, Mich.**

13 *tools..but only* 1 *setup*



Photographs by courtesy of Curtiss-Wright Corp., Propeller Division

Multiple tool setups are often complicated and expensive, and sometimes prohibitive, but in this case the value of careful job analysis has in practice proved to be productive, accurate and economical.

Requirements in slides, tool function and blade support (details omitted) all combine to the successful machining of propeller hubs, which includes straight turning, taper turning, grooving, etc.

Whether the work be small and delicate or large and rough, our engineers will be glad to work with you in determining efficient methods of machining.

Time is saved. This 12" Monarch is equipped with double-power angular feed, for machining both angles of a bevel gear, simultaneously.

MONARCH LATHES

COVER THE TURNING FIELD

THE MONARCH MACHINE TOOL COMPANY · SIDNEY, OHIO

MACKLIN GRINDING WHEELS

HELPFUL HINTS

and

Safety Suggestions

YOU MEAN YOU SHOULD ALWAYS TRUE THE WHEEL FROM THE CENTER?
When using diamonds for the truing operation, always start from center and work to corners. This is done as a precautionary measure, as the corners wear to a slightly smaller diameter. .001" per pass should be sufficient.
HEY! DONT TRY TO REMOVE ALL THE STOCK IN ONE PASS
Operators are often tempted to remove too much stock in one pass on the work. This causes the grinding wheel to break down too quickly, resulting in uneven wear and unsatisfactory finish.
[21]

GET YOUR COPIES OF THIS FREE BOOK

Many of the larger as well as the smaller users of grinding wheels have found this 64 page booklet so valuable that they have requested as many as 100 copies for distribution through their grinding departments.

Comments with requests for additional copies have been highly enthusiastic on the instructive value of the contents.

Already in its second printing, this illustrated booklet contains *Know How* facts invaluable as an aid in the operation and care of grinding wheels, and particularly for the instruction of new grinder hands. Do not hesitate to call on us for an adequate number of copies to cover your needs.

INVEST IN WAR BONDS

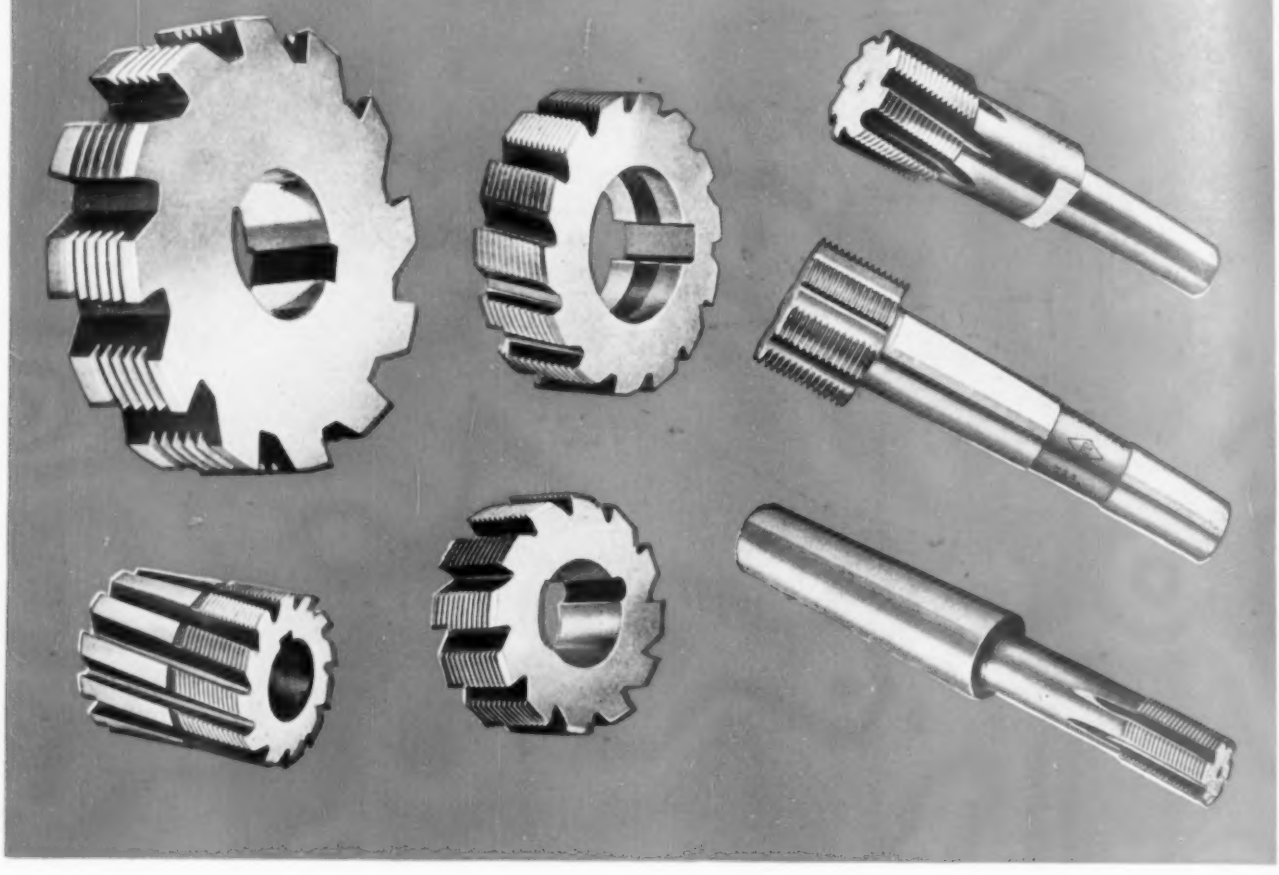
MACKLIN COMPANY

Manufacturers of GRINDING WHEELS — JACKSON, MICHIGAN, U. S. A.

Distributors in all principal cities

Sales Offices: — Chicago - New York - Detroit - Pittsburgh - Cleveland - Cincinnati - Milwaukee - Philadelphia

Multiple Thread Mills



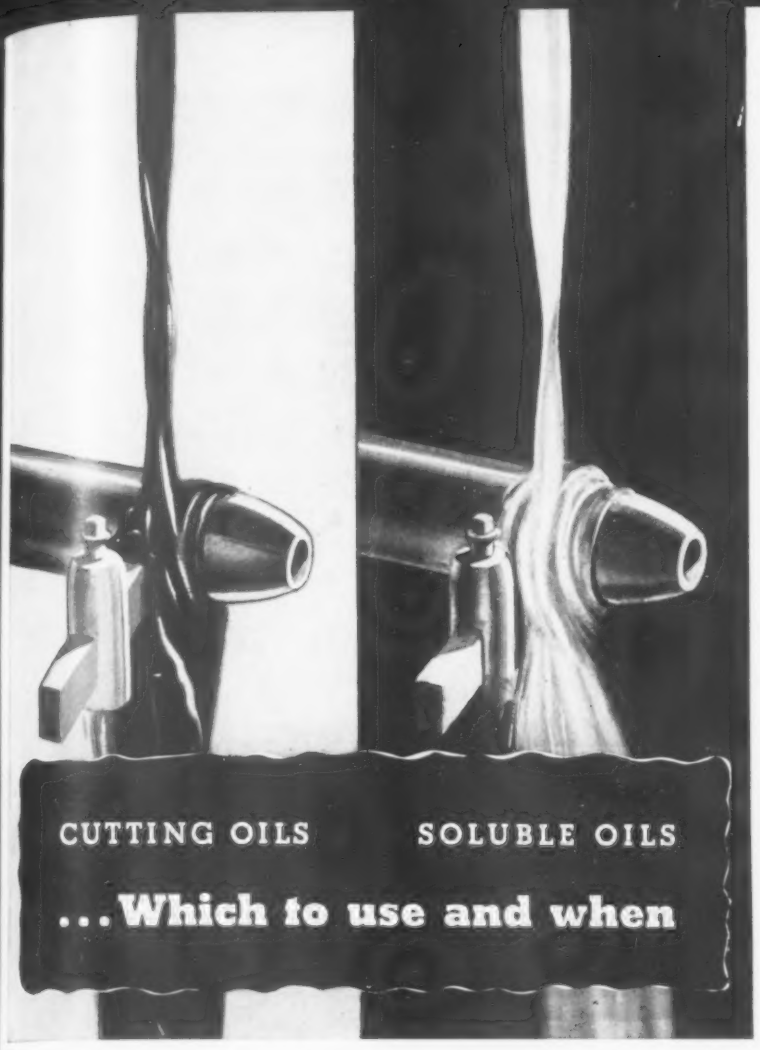
For economical production, with close tolerances required, P M Diamond Emblem Multiple Thread Mills are available in wide variety.

These mills are made of high speed steel, *with threads ground to exact dimensions.* Each tool carries the P M trade-mark, as your guarantee of precision performance and long life.

Prices and delivery dates will be quoted on request.

The PIPE MACHINERY COMPANY Cleveland, O.

GAGES • HOBS • MILLING CUTTERS • SPECIAL TOOLS



● Cutting fluids—emulsifying and non-emulsifying—have definite uses in machining. Neither type will do *all* the jobs efficiently in most plants. The choice between them depends upon many factors: the type of operation, speeds, feeds, and metals worked; tool life, and the finish required.

The extra time and trouble it may take to find exactly the right cutting fluid for any operation will pay dividends in faster production, labor saving, and tool economy.

Cutting fluids have two main functions:

1 To carry away heat from the tool and work.

2 To reduce adhesion between tool and chip.

Machining operations may be roughly divided into four classes, and the cutting fluid requirements for each generally laid down as follows:

Type of Operation	Important function in **black type**
Low speed, shallow cut	**cooling** / reducing adhesion
Low speed, heavy cut	**cooling** / **reducing adhesion**
High speed, shallow cut	**cooling** / reducing adhesion
High speed, heavy cut	**cooling** / **reducing adhesion***

**Note—except where carbide-tipped tools are used.*

Oil is ammunition . . . Use it wisely

Cutting Oils are used:

—in low viscosities, as coolants, and also to reduce adhesion.

—in higher viscosities to reduce adhesion and lengthen tool life on heavy cuts.

—on any machines in which a water emulsion would impair the lubrication of ways, guides, spindles, etc.

Soluble Oils are usually used:

—where cooling is paramount and there is little need for reducing adhesion.

—where a cutting fluid would not normally be needed, such as on low speed shallow cuts, except to prevent rusting.

—in most grinding operations because of the great need for cooling. In addition, a water emulsion allows minute grindings to settle out quickly and reduce scratching of the work.

—on operations such as drilling where fine finish is not essential.

—where carbide-tipped tools are used which require maximum cooling.

—on some deep drilling or boring operations where the fluidity of the emulsion assures ample flow of coolant to the tool.

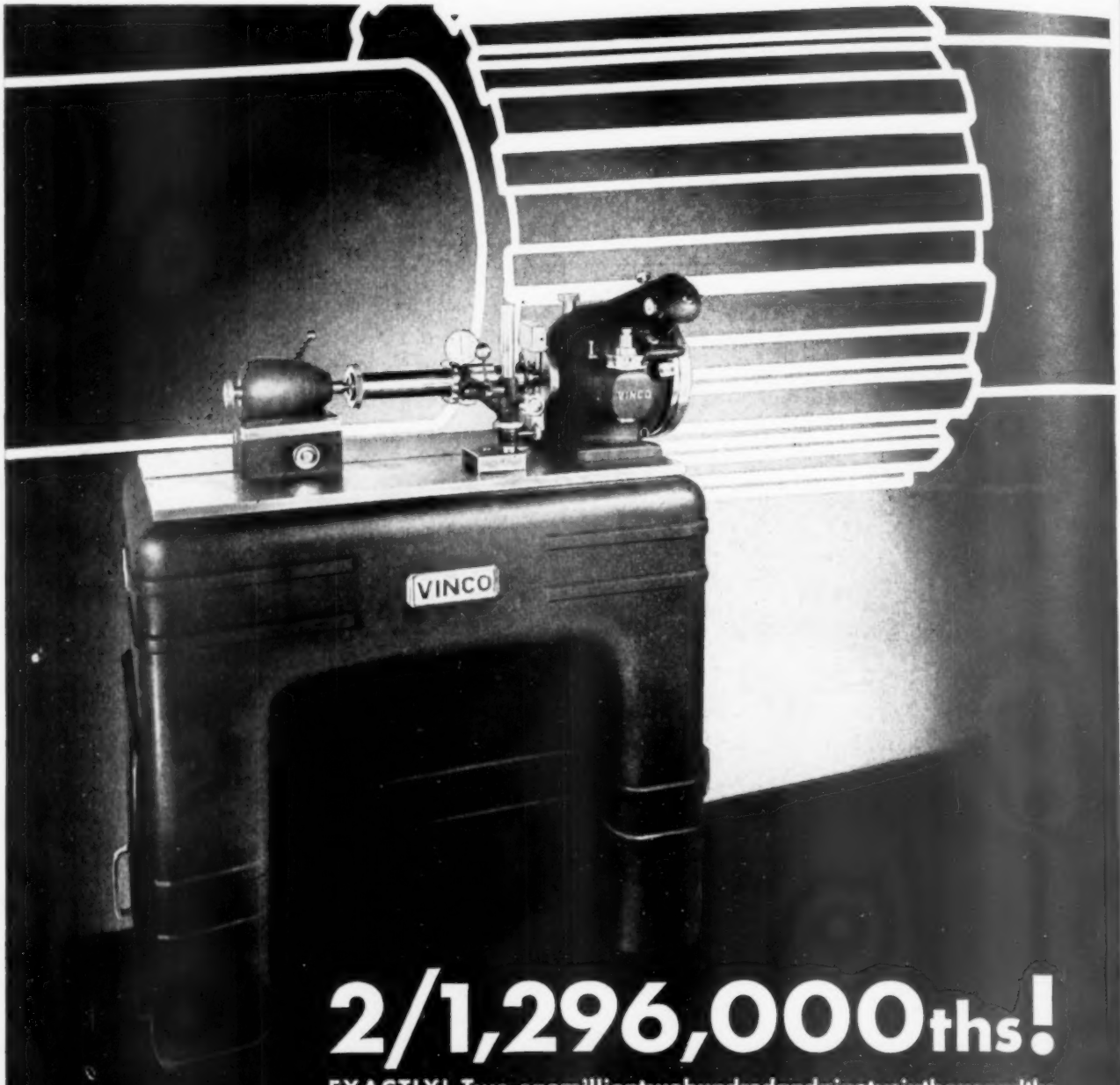
These suggestions are merely guides in the choice of cutting fluids. Almost every machining operation poses a special problem. To make certain that you get the most economical answer get a Standard Cutting Oil Engineer's recommendations.

Call the nearest Standard Oil Company (Indiana) office, or write 910 South Michigan Avenue, Chicago, Illinois, for the Engineer nearest you. In Nebraska, call any Standard Oil Company of Nebraska office.

Standard Oil
CUTTING OILS
AND COOLANTS

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

LUBRICATION ENGINEERING • • LUBRICATION ENGINEERING • • LUBRICATION ENGINEERING • • LUBR



2/1,296,000ths!

EXACTLY! Two-onemilliontwohundredandninetysixthousandths part of a circle! THAT'S SMALL, ISN'T IT? That is only TWO SECONDS OF ARC! That would be, let's see—mmmm—less than .0006″ on the circumference of a circle 10 feet in diameter . . . less than 1/3 of an inch on a circumference of MORE THAN THREE MILES!

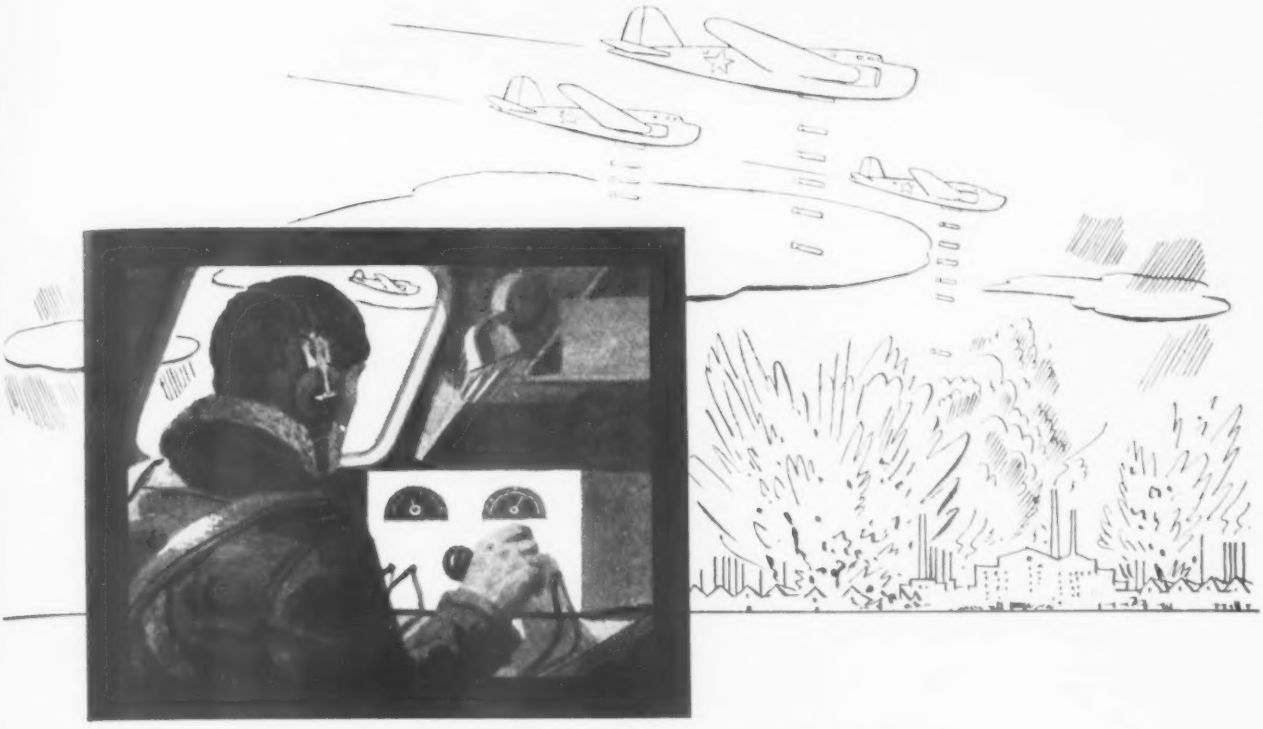
What does it mean? Why, that is the amount of error that creeps in on the VINCO OPTICAL MASTER INSPECTION DIVIDING HEAD'S accuracy. Sometimes it is even less!

Today, most of the great producers of armament in America are using the VINCO DIVIDING HEAD to check gears, index plates, splines, cams, camshafts, etc., to limits that formerly were believed impossible.

Further information regarding this accurate inspection instrument will be sent upon request.

MILLIONTHS OF AN INCH FOR SALE BY VINCO

VINCO CORPORATION
8857 SCHAEFER HIGHWAY
DETROIT • • MICHIGAN



Gulf Cut-Aid steps up production of airplane radio covers 20% –rejections entirely eliminated

Another example of the superior performance of Gulf's revolutionary new cutting oil

Rejections due to cracking from excessive heat generated in the tapping operation was the bottleneck in the production of aluminum airplane radio covers in a large instrument plant until Gulf Cut-Aid was used as the cutting fluid. With soluble cutting oil, one cover out of every five cracked as the tap cut the threads in a one-inch drilled hole.

With Gulf Cut-Aid, this bottleneck was eliminated immediately! Since adopting Gulf Cut-Aid over 500 covers are tapped without a single cover being cracked. Result: Rejections entirely eliminated, production increased 20%.

In plant after plant, Gulf Cut-Aid is demonstrating its superiority as a cutting fluid for aluminum and other non-ferrous metals.

In addition to its function as the ideal cutting fluid, Gulf Cut-Aid has another important function—it is an effective energizer for other cutting oils, regardless of type or viscosity. Blended in varying proportions depending upon the various requirements of the job, the use of Gulf Cut-Aid with other cutting oils makes possible higher cutting speeds and results in improved finish or longer tool life, or both.

Call in a Gulf Service Engineer today and let him demonstrate—in your plant—how Gulf Cut-Aid and other Gulf quality cutting oils can help improve your machining practice. Gulf Oil Corporation, Gulf Refining Company, Gulf Building, Pittsburgh, Pennsylvania.

Mail This Coupon Today

GULF INDUSTRIAL LUBRICATION

Gulf Oil Corporation — Gulf Refining Company TE
3800 Gulf Building, Pittsburgh, Pa.

Please send me, without obligation, a copy of the new revised booklet, "Gulf Cutting Oils," which includes a helpful Machining Guide.

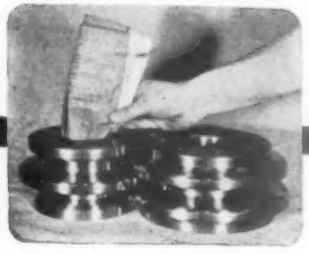
Name _____

Company _____

Title _____

Address _____

Just what the Roll-Grinder ordered!



FOR the first time it has ever been done . . . the best ideas gained by years of experience in a production roll-forming shop, have been engineered and built into a grinding machine. Specially designed for the grinding of rolls, it does this job quicker and easier. Its set-up facility lowers costs and the handling ease reduces the fatigue factor. Both are of paramount importance in the efficient operation of the grinding of rolls.

"The Yoder ROLL-GRINDING MACHINE HELPS TO *Keep 'Em Rolling!"*

Yoder

ROLL-GRINDING MACHINE

- Capacity 16" diameter, length 20" between centers.
- Manually synchronized table and cross feeds.
- 2 speed table feed.
- 9 speed work head drive, without belt or gear change.
- Precision built high-speed spindle.
- Dust protection.
- Centralized controls.

WRITE or WIRE or PHONE for Bulletin, Delivery or Price Information.

THE YODER COMPANY
CLEVELAND, OHIO, U.S.A.

METAL • FORMING • PRODUCTION • MACHINERY

ENGINEERING YODER MANUFACTURING

Today's Pioneers Are Planning Committees

Out of the pioneer meetings came our early progress; out of today's Planning Committees in many organizations and industries will come security and prosperity for a new America.

Every Friday night at 1088 Ivanhoe Road the lights burn late while the Reliance Future Planning Committee is at work. At other times, these Reliance engineers, production and sales men devote their energy to making more war goods, quicker.

But, one night a week in true pioneer spirit, they tackle the problems of electric motors and motor-drive of the future. They start from scratch. They take nothing for granted. They assume there is a better way to build every motor; and that no motor-drive problem is unsolvable.

Their past performance is a guarantee of big things to come. They've licked some pretty tough assignments in many different industries—and even tougher ones for our armed forces. They have "on tap" many important developments in simple, flexible, production-boosting, electric motor-drive and control.

Reliance engineers—pioneers in their field—are available to help *you* with your motor-drive problems.

Friday Night at Reliance

RELIANCE A·C D·C MOTORS

RELIANCE ELECTRIC & ENGINEERING CO.

1088 Ivanhoe Road • Cleveland, Ohio

Birmingham • Boston • Buffalo • Chicago • Cincinnati • Detroit • Greenville (S.C.) • Los Angeles • New York
Philadelphia • Pittsburgh • Portland (Ore.) • St. Louis • San Francisco (Calif.) • Syracuse (N.Y.) and other principal cities.

● *Aro Model 22BGS with Rotary Burr being used to clean up Aluminum Castings. Less Weight — Less Fatigue. More Speed and Power—More Production. Ideal for women workers.*

FINISHING TIME CUT ONE-HALF WITH ARO PNEUMATIC TOOLS

● At the suggestion of an Aro Field Engineer, a large midwestern aluminum foundry has effected big time savings by using Aro Model 22BGS with Rotary Burrs and Files for "cleaning up" operations on aluminum castings. Experience has shown that its speed of 17000 r.p.m. gave the following results:

1. Greatly increased production, due to high speed.
2. Better finish obtained on casting.
3. Burrs did not load as fast.
4. More pieces per burr.

Possibly in your plant, too, there are numerous operations which can be performed more quickly and more efficiently through the use of these small, powerful Pneumatic Tools.

Aro Field Engineers will welcome an opportunity to give you the benefit of their wide experience in helping you solve production problems of various kinds involving Grinding, Burring, Filing, Drilling, Screwdriving, Nutsetting, etc. Your request for information will receive high priority attention.

THE ARO EQUIP. CORP.
PNEUMATIC ARO TOOLS
BRYAN, OHIO

New HARDINGE bulletins available to users of Brown & Sharpe machines

The inside pages of this bulletin give helpful information for ready identification of Brown & Sharpe style collets and feed fingers. It clearly presents customary use of each style and lists attractive prices.

QUESTION:
When feeding steel bars, aluminum bars, or tubing—
3 different tensions are required.
How can you do this with ONE Feed Finger?
ANSWER:
HARDINGE
Master Feed Fingers with Adjustable Tension

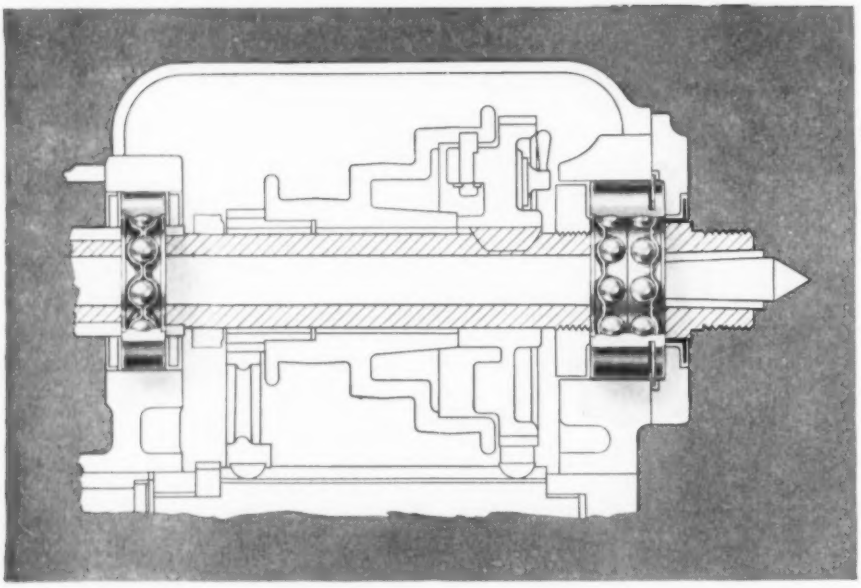
Describes the advantages of HARDINGE Master Feed Fingers with adjustable tension for No. 00 and No. 0 Brown & Sharpe machines.

Address your inquiry for these free bulletins to HARDINGE BROTHERS, INC., ELMIRA, N. Y.

HARDINGE
ELMIRA, N.Y.

SUSTAINED *Spindle Accuracy!*

☆ A FINER FEATURE OF LOGAN LATHES



Brief
SPECIFICATIONS

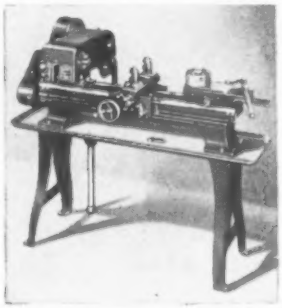
- Swing over bed 10½"
- Bed length 43⅛"
- Spindle hole 25/32"
- Precision ground ways: 2 prismatic "V" ways; 2 flat ways
- 12 spindle speeds—30 to 1450 per minute

Precision, Pre-Loaded Ball Bearing Headstock is Standard Equipment on All Models

Your purchase of a lathe is an investment. To be profitable, it should be a ***long term*** investment in speedy, accurate production. It will be if the lathe is a Logan, because Logan engineering designed it that way... throughout! For example, to assure sustained accuracy of the spindle, the headstock is equipped with special New Departure Ball Bearings. These bearings, of extreme precision, are pre-loaded so that the pressure of the cutting tool... either radial or thrust... causes a minimum deflection of the spindle. In addition to "pre-loading"... these ball bearings are grease sealed... requiring no lubrication and no adjustment for their entire life. Moreover, the higher operating speed of the Logan Lathe, due to its ball bearing spindle mounting, enables a shop to take every advantage of modern, high speed cutting methods. Production is increased and unit costs reduced.

Write for catalog sheets so that you can compare before you buy.

NO. 200 BACK GEARED SCREW CUTTING LATHE



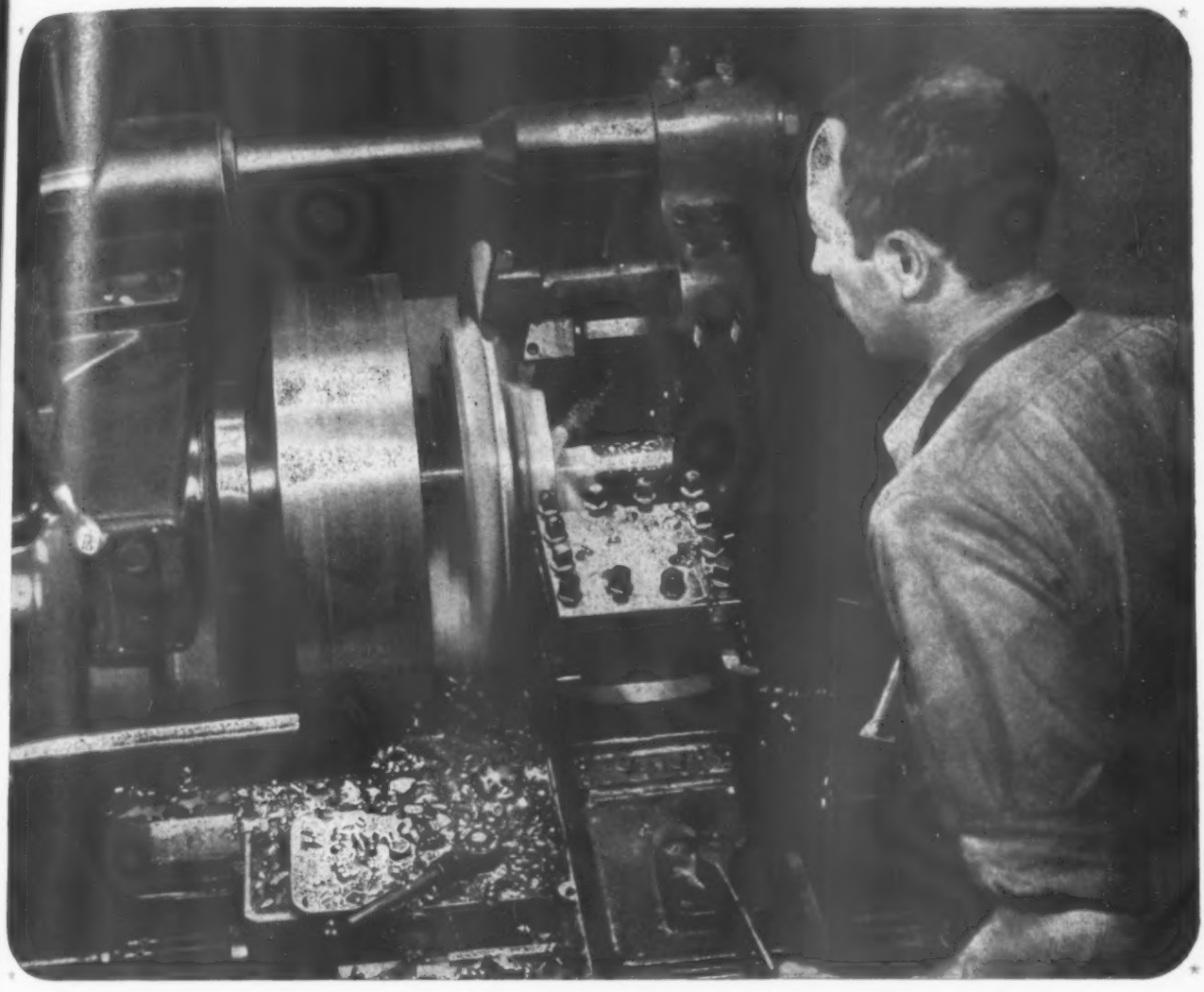
NO. 850 MANUFACTURING TURRET LATHE

NO. 830 ⅝" CAPACITY HAND SCREW MACHINE

LOGAN ENGINEERING COMPANY
CHICAGO, ILLINOIS

Logan

A NAME TO REMEMBER WHEN YOU THINK OF LATHES



Two TOOL STEELS CAN CUT AS CHEAPLY AS ONE

WHAT'S more important, two tool steels can cut twice as *fast* as one, and speed is the prime urgency in war production.

But there are ways of increasing production beside installing more modern types of machine tools. A better tool steel, or one better suited to an individual job, can materially speed up the work your existing equipment is capable of doing.

Take the case of a big Detroit plant, using DBL High Speed Tool Bits instead of a high-tungsten variety, machining castings of X-1340 steel with a surface hardness of 33 Rockwell C, and a subsurface hardness of 26-28C. The DBL Tool Bits showed 30% increase in work done between grinds, running at 166 RPM against a previous speed of 100 RPM.

Our Service Staff is ready to help you team up tool steels with your production jobs, for more work done per machine. They'll show you the best *alternate* steels, too, as a protection in event of shortages.

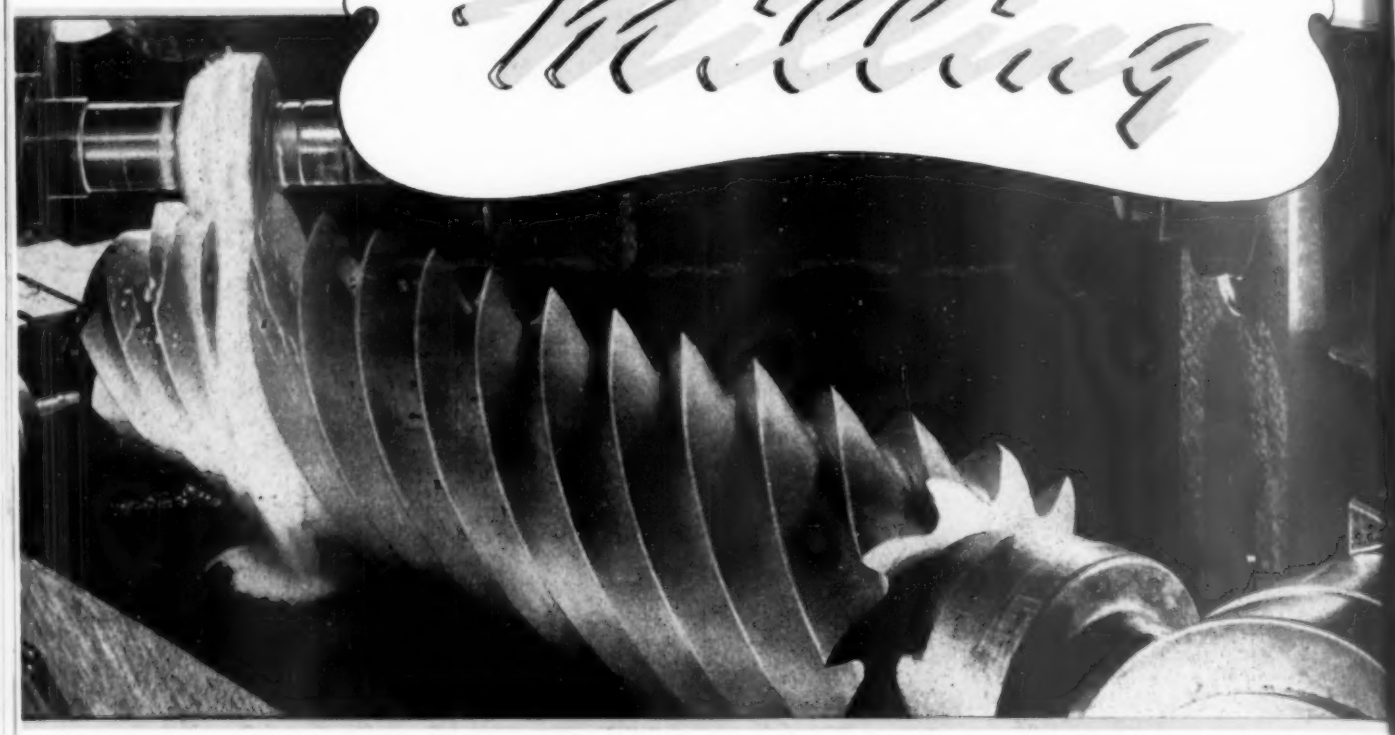
ADDRESS DEPT. TE-3

AL
STEEL FOR THE NATION'S WELFARE

Allegheny Ludlum
STEEL CORPORATION
BRACKENRIDGE, PENNSYLVANIA

A-8865 . . . W & D

ILLINOIS TOOL *Milling*



where DESIGN and PRECISION combine to create better tools!

In making an efficient cutting tool, whether it be a hob, broach or cutter, the milling operation is of extreme importance. Precise and skillful craftsmanship is required to produce the tool exactly as designed. This is particularly true when special construction features are incorporated.

The illustration above shows an Illinite Slab Milling Cutter being milled with extra large fillets designed to follow the natural chip curvature for maximum removal of material. This is typical of the special construction provided in Illinite cutters to achieve utmost efficiency in accordance with the specific purpose of the tool.

Discuss your tool design problems with an Illinois Tool engineer—his suggestion will point the way to increased production through greater tool efficiency.

OVERNIGHT
TO ALL AMERICA . . .
FROM THE HUB OF
AIR TRANSPORTATION

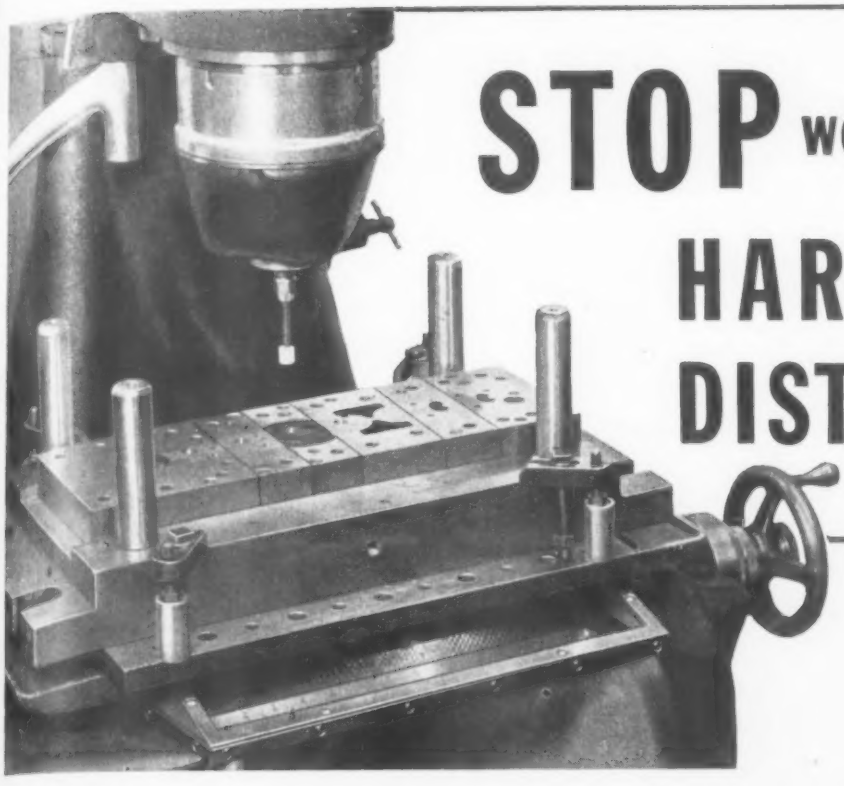
ARMY E NAVY

ILLINOIS TOOL WORKS

MANUFACTURERS OF METAL CUTTING TOOLS AND SHAKEPROOF PRODUCTS
2501 N. Keeler Avenue, Chicago, Illinois
In Canada: Canada Illinois Tools, Ltd., Toronto, Ontario

ILLINITE

HOBS • BROACHES • SHAPER CUTTERS • GEAR CUTTERS
MILLING CUTTERS • GROUND FORM TOOLS • SPECIAL TOOLS



STOP worrying about HARDENING DISTORTION!

USE THE MOORE JIG GRINDER

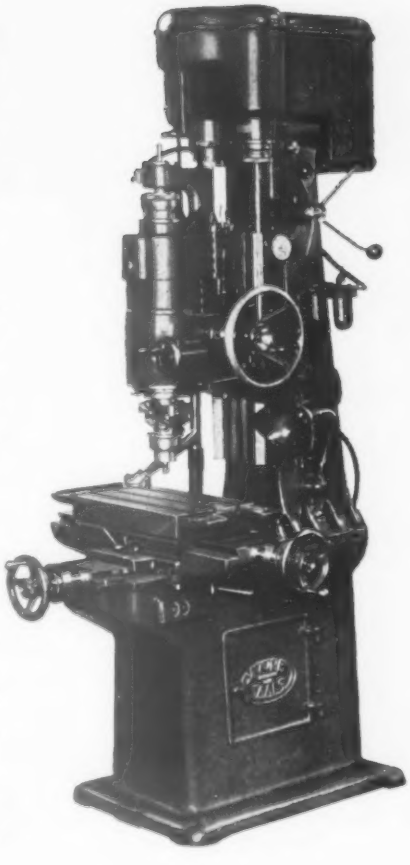
How would you do this job without a Moore Jig Grinder? Most likely you would swing each of the six sections up on an internal grinder, going through all of the laborious steps of centralizing, locating, indicating, grinding, re-assembling and checking. With the Moore Jig Grinder you do it all in one setting, with the die completely assembled in its own die-set and located on its own dowels—*in one-quarter the time!*

Until recently, distortion due to hardening was a bugaboo in the production of tools and dies for precision parts. Correcting the position of holes after hardening was a costly, highly skilled, and, at best, makeshift process. But with the Moore development of the Jig Grinder, a machine new to tool-and-die practice, you can now with speed and ease relocate your holes and finish-grind them, straight or tapered, *within .0001".*

The Jig Grinder was created in the Moore toolrooms by Moore tool-and-die specialists specifically to solve the problem of hardening distortion on dies, drill jigs, master plates and precision gage parts. Besides saving toolroom time, it increases the life of a die from two to twenty times that of an unground die. It has a capacity to grind holes from .030" to 4", accuracy of screws of .00005" per inch, and grinding speeds of 15,000, 25,000 and 45,000 RPM.

Partner in Production

Moore Jig Borer bores the holes in these die sections before hardening, thus holding the location as close as possible to eliminate excessive grinding. Send for literature on both machines.



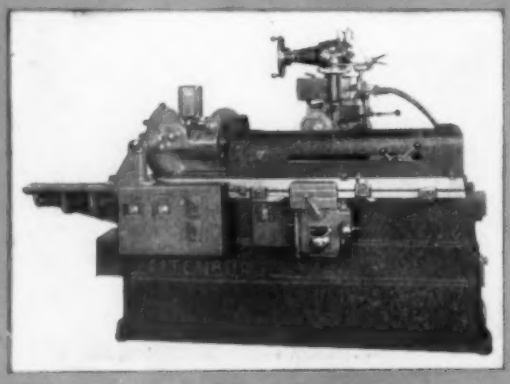
Manufactured by MOORE SPECIAL TOOL CO., INC · Bridgeport, Conn.

MOORE TOOLS

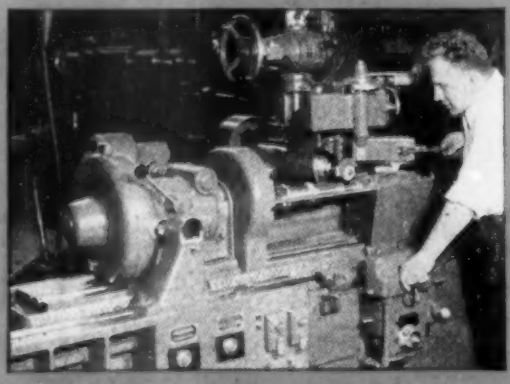
EXCLUSIVE DISTRIBUTORS: MARBURG BROTHERS, INC • 90 WEST STREET, NEW YORK, N. Y.

Get all 3 - DIMENSIONAL ACCURACY PERFECTION OF FINISH PRODUCTION SPEED

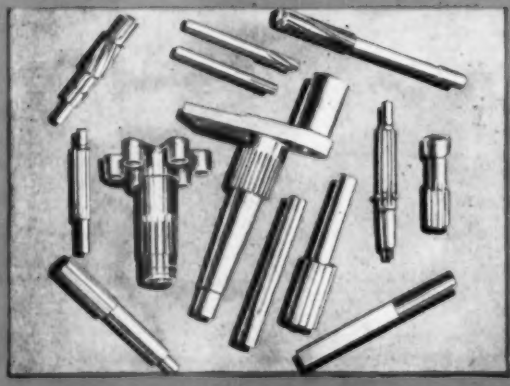
with FITCHBURG *Automatic Closed Cycle Grinding*



FITCHBURG SPLINE GRINDER



GRINDING SPLINES ON WRIGHT AIRPLANE CRANKSHAFTS



EXAMPLES OF WORK GROUND ON FITCHBURG SPLINE GRINDER

The Fitchburg formed wheel grinding method, with automatic closed cycle, produces a wide variety of splines for automotive, airplane and marine industry with fine finish, accuracy and high speed. This results in smoother product performance.

Here are some of the outstanding features of the Fitchburg Spline Grinder:—

These machines are designed so that new operators can be trained quickly to operate them — an important factor in these times.

Wheelhead column may be arranged to swivel to a maximum of 20 degrees for either right-hand or left-hand helical lead angle when helical attachments are furnished.

Elevating mechanism is mounted on top of the column for the convenience of the operator.

The headstock may be furnished for either straight, right-hand, or left-hand helical splines.

The index plate is mounted at the left-hand end of the headstock so that it may be removed easily for changing plates. There is a standard 16 key plate which will take care of 2, 3, 4, 6, 8 and 12 spline shafts by inserts in the index notches. Separate index plates are necessary for other spline divisions.

Many leading industrial plants in the United States are using Fitchburg grinding equipment to speed production and save man hours. Let Fitchburg engineers show you how to speed production by this modern grinding method.

Write today for this catalog showing wide range of successful operations.

FITCHBURG GRINDING MACHINE CORP.

FITCHBURG, MASSACHUSETTS, U. S. A.

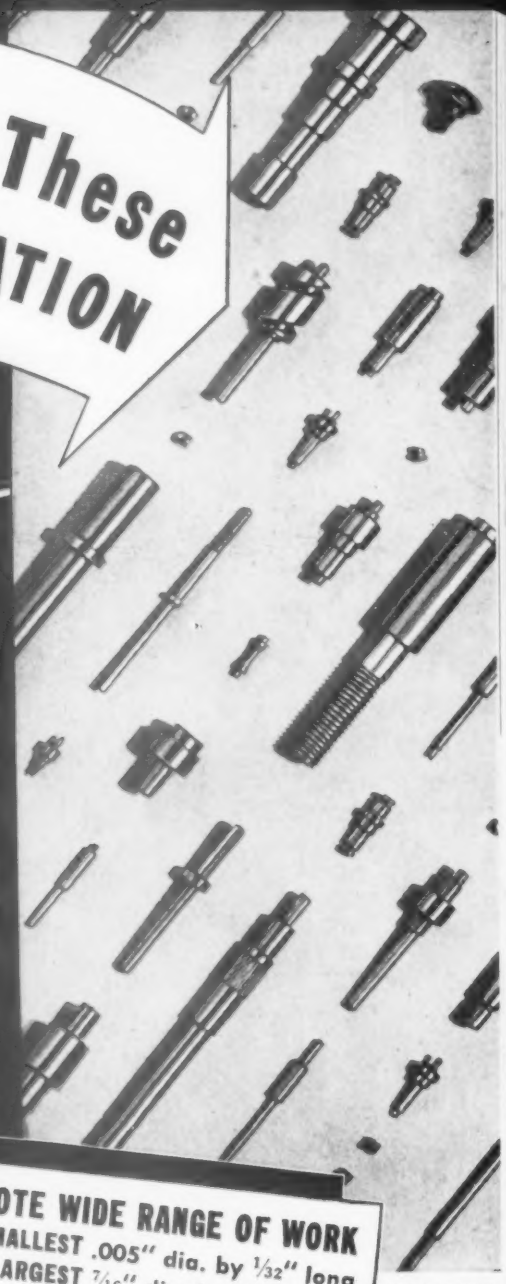
Manufacturers of—Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Bath Full Universal Grinders and Special Purpose Grinders.

PRECISION PARTS Like These *Complete*..IN ONE OPERATION

Product of Two Names Famous for *Precision*

The Original Swiss PETERMANN Model P-7

Re-engineered by GORTON Improved · Modernized



NOTE WIDE RANGE OF WORK
SMALLEST .005" dia. by 1/32" long
LARGEST 7/16" dia. by 2¾" long

PARTS SHOWN ACTUAL SIZE

GORTON 16-A Precision Automatic Screw Machine achieves new advances in accurate, high speed, versatile screw machine production. Diameters from .005" to 7/16" and lengths from 1/32" to 2¾" demonstrate the extensive range of work which can be produced on the 16-A.

The samples, shown here in actual size, represent the almost endless variety of simple and complex precision parts which the 16-A produces—complete—in *one* operation.

In addition to step and contour turning and chamfering, the 16-A, with attachments, also automatically performs centering, drilling, threading and slotting operations.

EXCEPTIONAL ACCURACY AND QUALITY OF FINISH—High diametrical accuracy—work rigidly supported at point of cutting tool load. Unusually high finish—grinding often eliminated.

LOW TOOL AND OPERATING COST—Maximum accessibility for quick setups. Uses only standard single point tool bits. Micrometer adjustments on every tool. Centralized controls—infinitely variable speeds and cam feeds at touch of dials.

LONG LIFE OF PRECISION PERFORMANCE—Slow, smooth operating movements, elimination of indexing or spindle reverse, and complete freedom from vibration insure a long life of efficient service.

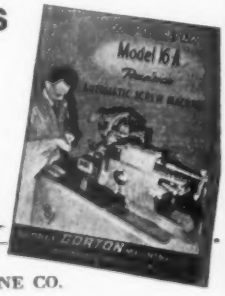
COMPLETE TOOL AND CAM SERVICE... *No charge or obligation*

UR GOLDEN NNIVERSARY 1893-1943

GET THE FACTS NOW

Write Today for FREE Bulletin

MAIL TODAY



GEORGE GORTON MACHINE CO.
1322 Racine St., Racine, Wis.

Send me, without obligation, FREE bulletin with complete information covering the Gorton 16-A Precision Automatic.

Name..... Title.....

Company.....

Address.....

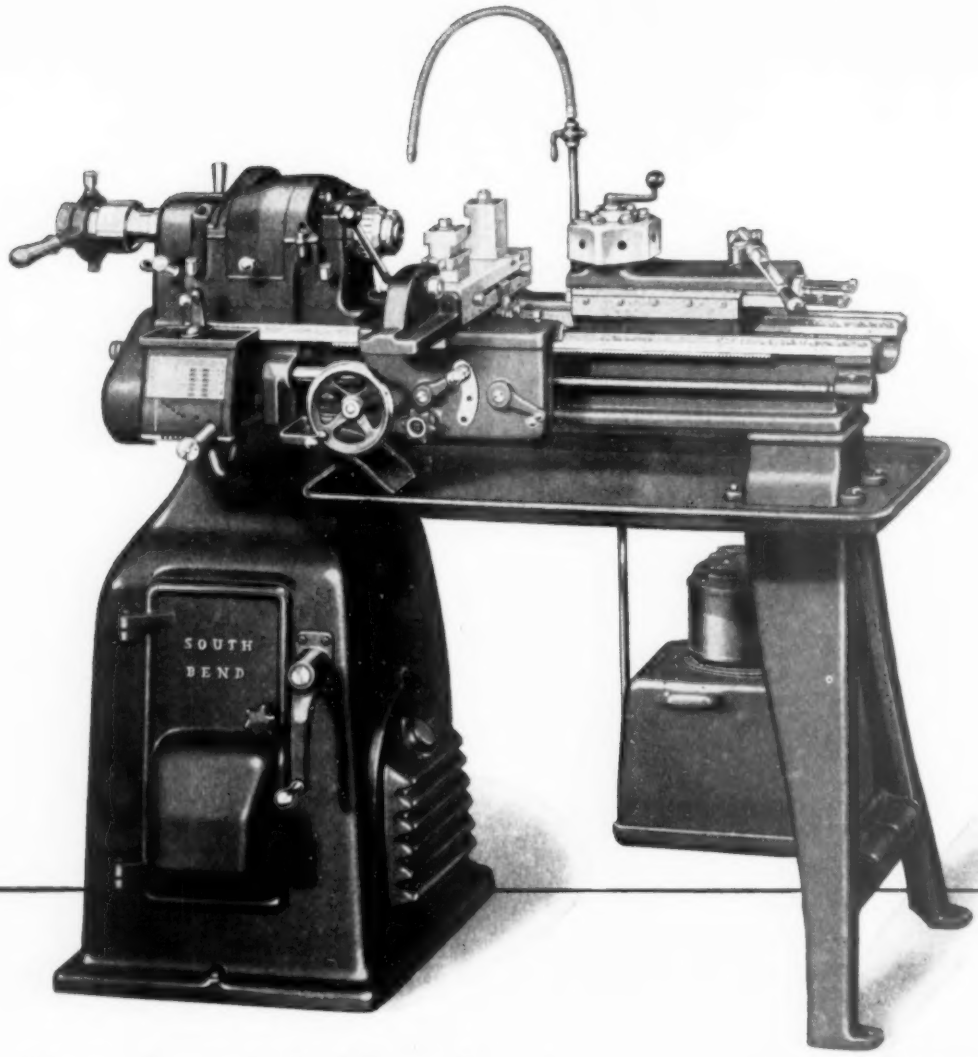
City..... State.....

GORTON 50 YEARS OF PRECISION TOOLS

GEORGE GORTON MACHINE CO.

1322 RACINE STREET, RACINE, WISCONSIN, U. S. A.

SPECIALISTS FOR 50 YEARS IN REPRODUCING FROM MASTERS—ENGRAVING, DIE MAKING, VERTICAL MILLING MACHINES

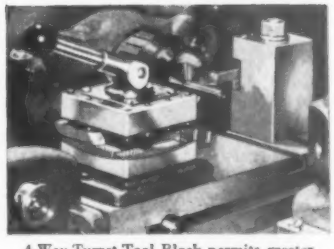


For Rapid Machining
OF SMALL PRECISION PARTS

In hundreds of important war production shops the new Series 1000 South Bend Turret Lathes are first choice for machining small precision parts. Highly efficient on all work within their capacity, these lathes are especially popular for close-tolerance, second operation jobs.

SPECIFICATIONS

Hole through spindle	1⅜″	Spindle speeds (12)	50 to 1357 r.p.m.
Collet capacity, round	1″	Thread cutting feeds (48)	4 to 224 per inch
Swing over bed and saddle wings	10⅛″	Universal carriage power feeds—	
Effective feed of turret slide	4″	longitudinal (48)	.0015″ to .0836″
Turret face to spindle, max.	19⅜″	transverse (48)	.0006″ to .0309″



4-Way Turret Tool Block permits greater number of operations per setup. Indexes to 4 positions. Optional equipment.

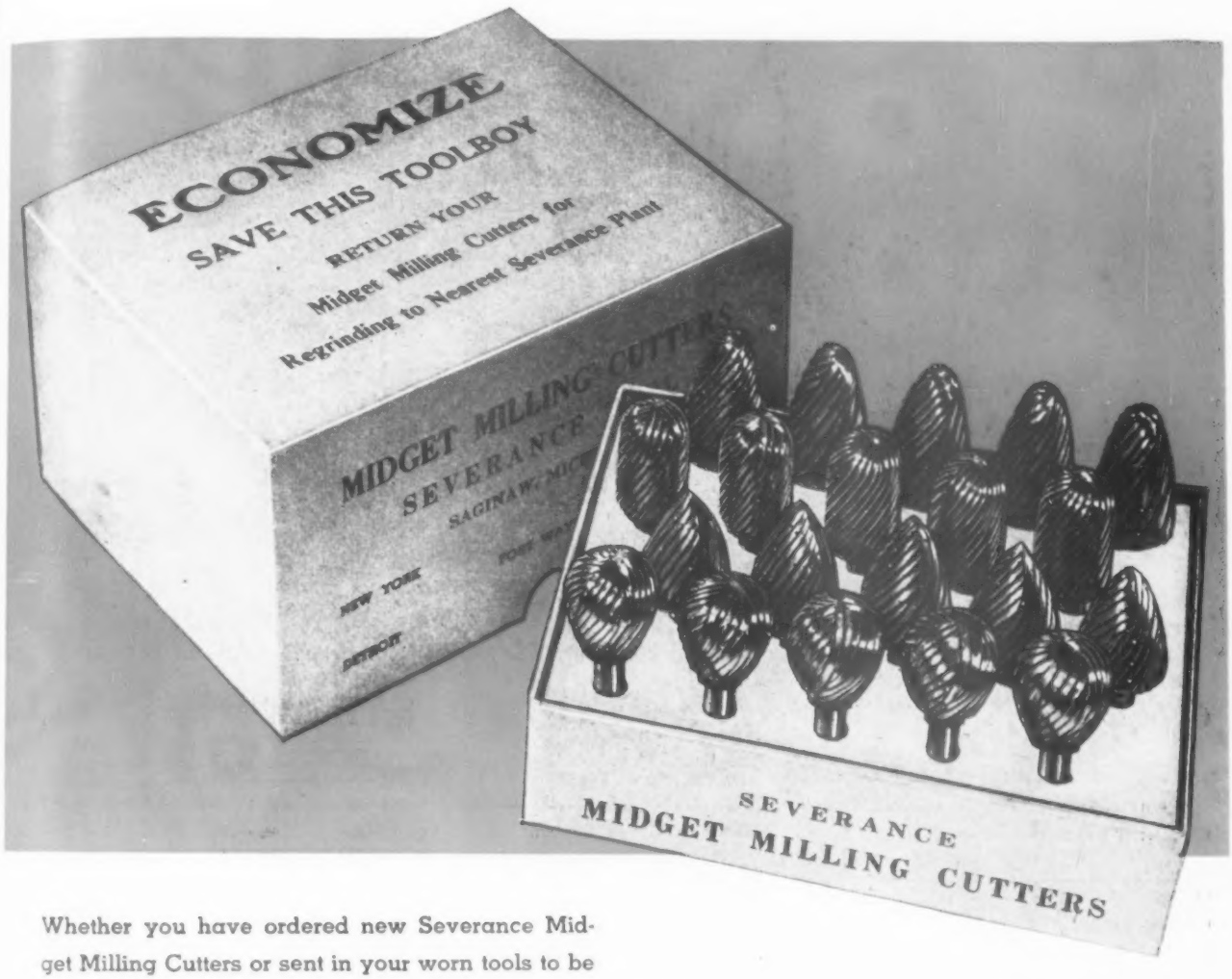
Compound Rest Cross Slide, interchangeable with Handlever Cross Slide, is also supplied as regular equipment.

South Bend Turret Lathes, Engine Lathes and Toolroom Lathes are made in a wide range of sizes and types. Write for catalogs and the name of our nearest dealer.

SOUTH BEND LATHE WORKS

LATHE BUILDERS FOR 36 YEARS — SOUTH BEND, INDIANA, U. S. A.

Severance TOOL BOY shipping container insures delivery of your tools in perfect condition . . .



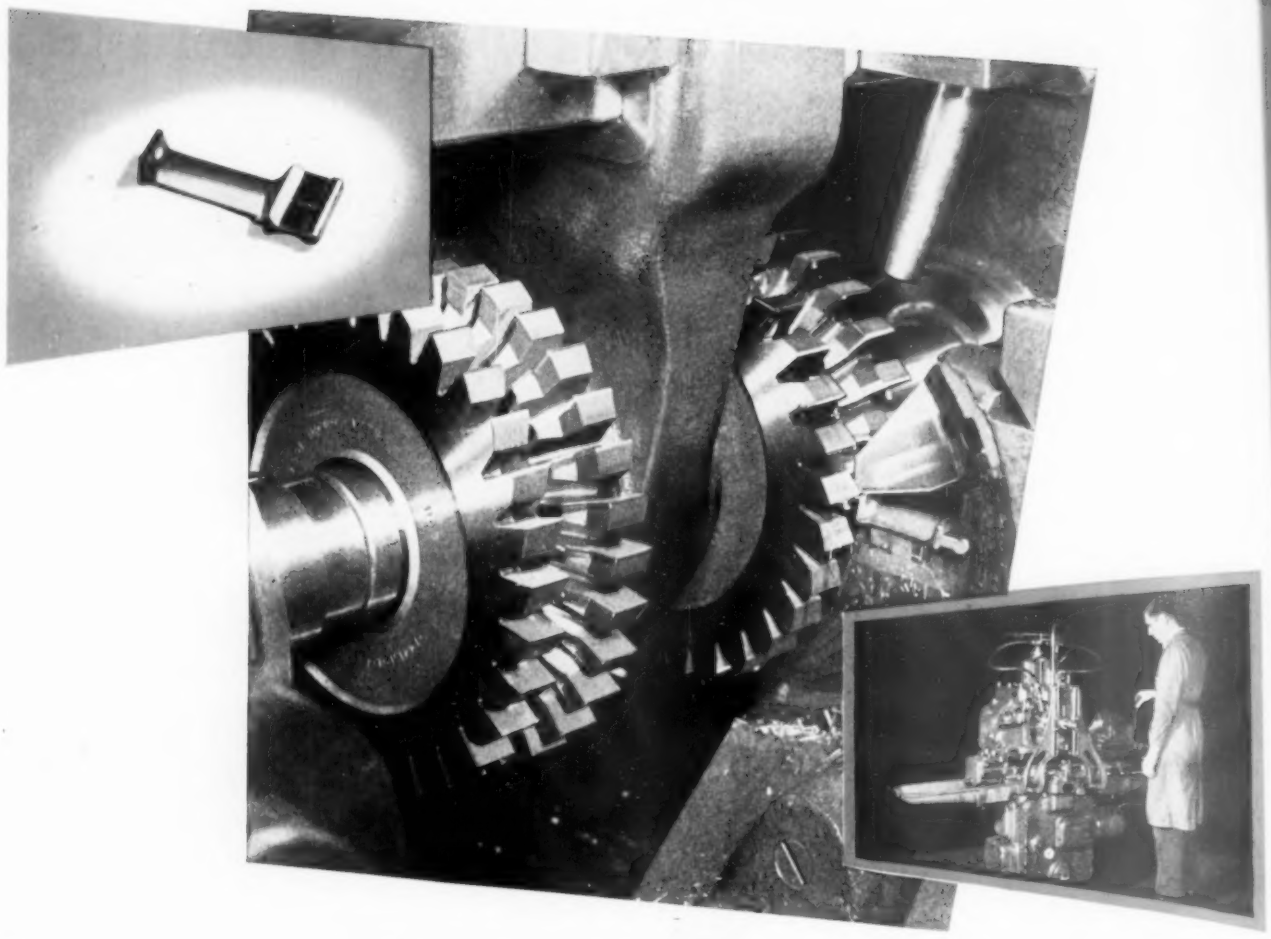
Whether you have ordered new Severance Midget Milling Cutters or sent in your worn tools to be Reground, you can be certain they will arrive at your plant in perfect condition. Tools shipped in the new Severance Tool Boy shipping container cannot touch one another—no matter how roughly the package is handled enroute. In your plant the Tool Boy serves as a handy container for dull cutters and can be used again for shipping tools back to Severance for regrinding.

Yet the Tool Boy is only one of many advantages you get when dealing with Severance. Because Severance Midget Milling Cutters are hardened to 63-65 Rockwell C, then ground by hand from the solid they cut clean, sharp chips and speed up the finishing of any metal, wood or plastic pattern, casting or part.

Because of the precision and care with which dulled and worn tools are reground at Severance you get tools as good as new at a fraction of new tool prices. Write today for complete facts.

Severance

MIDGET MILLING CUTTERS • PRECISION REGRINDING
SEVERANCE TOOL INDUSTRIES, INC., SAGINAW, MICH. •
PLANTS IN LONG ISLAND CITY, N.Y.; DETROIT, MICH.;
FORT WAYNE, IND.; CHICAGO; AND LOS ANGELES



with B-C *Accurate Sizing . . . to .0003"* SPECIAL STEPPED STRADDLE MILLS

THIS important piece in a vital war machine is finished in three milling operations from a tough steel forging. The first operation, which consists of straddle milling the sides of the piece, is shown in the photographs above. A two-position reciprocating table is used on the milling machine so that one position is cutting while the other is being emptied and reloaded. Two sets of cutters on the arbor are used, as shown. The cut is parallel most of the way and flares at a precise angle on the step. The width, and the position of the step, must be held within +.0003" −.0000". The Barber-Colman Milling Cutters used in this operation were *specially designed for the job* by experienced B-C small tool engineers, based on requirements of extremely fine finish and close tolerances. Their outstanding performance is full testimony of our engineering department's ability to design Better Cutters. You, too, can profit from this engineering service by taking your cutter problems to your Barber-Colman representative nearest you, or by sending the data directly to us.

PRODUCTION DATA

Material — Tough Steel, Work Hardens.
Feed — 5⅛" per minute.
Cutter Speed — 70 R.P.M.
Stock Removal — Width ⅜", Depth 1¾".
Machine — Sundstrand No. 1 Rigidmil. Special table.
Holding Means — Special Fixtures.
Production — 120 pieces per hour, increase of 84%.
Pieces per Cutter Sharpening — 2000.
Production with former method — 65 per hour.

CUTTTING TOOLS ARE SCARCE
MACHINES CAN'T RUN WITHOUT THEM
CONSERVE WHAT YOU HAVE

Buy War Bonds

BARBER B-C COLMAN PRODUCTS
HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

Barber-Colman Company

GENERAL OFFICES AND PLANT • 213 LOOMIS STREET • ROCKFORD, ILLINOIS, U. S. A.

Important New Features!

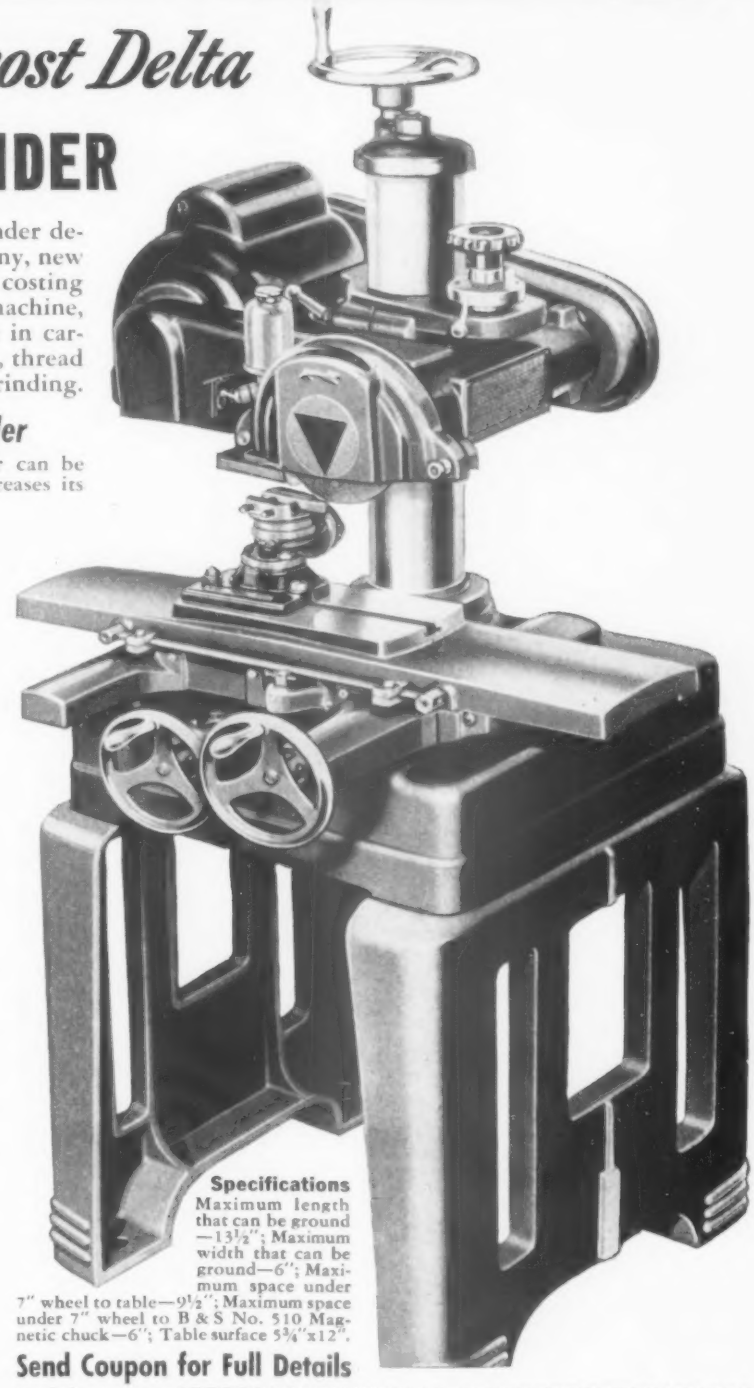
on this new Low-cost Delta

CHIP-BREAKER GRINDER

In addition to the best features of standard grinder design—this new Delta machine incorporates many, new exclusive improvements not found in grinders costing many times as much. It is a big, heavy, accurate machine, designed for grinding the chip-breaker groove in carbide-tipped tools—also for grinding form tools, thread chasers and other units requiring accurate grinding.

Can Also Be Used as Surface Grinder

By simply removing the universal vise, this grinder can be used as a regular surface grinder—which greatly increases its usefulness to both large and small shops.



Some of the "Highlights" of this Big, Solid, Accurate Machine

Production men who see this grinder for the first time are invariably astonished at its many features and its low cost. Some of the outstanding points are:

NEW "UNIVISE" The Univise for grinding, drilling and light milling. Rigid, heavy, massive, it is built of four component parts each with a separate circular scale of 360° and each of which can be independently rotated and set. Thus it has four distinct planes of adjustment which means that any angle can be easily and speedily obtained. By simply making a record of settings of each scale for duplicate grinding, the vise can be quickly reset to exact original angle. Jaws take tools up to 1½". Has detachable keys on base which can be removed to permit use of vise on drill press or other machines without table slots, or on a magnetic chuck.

Improved, Well-Designed Spindle — the "heart" of any Surface Grinder—made extra long with bearing at either end, widely spaced. Forward bearing is large surface taper bronze bearing of design usually found only in much more expensive grinders—rear bearing is sealed-for-life ball bearing.

Special Wheel Mounting System — utilizes two-piece adapter so that either wheel, or wheel and adapter, can be removed. Thus once wheel has been trued up, wheel and adapter can be removed and replaced without need of re-dressing wheel.

Improved Table — smooth operating, with conveniently located control handles—has long ways so that table rides solidly. Gibs provided so that all play due to wear can be eliminated. Micrometer collar, with wide graduations on the traverse adjustment permits accurate settings. The table is provided with T-slot for clamping fixtures or magnetic chuck in place.

Specially Designed Column — of one-piece construction, cast of high-tensile iron, normalized and accurately ground to close tolerances. Steel gib guides bracket yoke so it is always in perfect alignment. Entire column together with bracket, can be rotated 360°.

Coolant Attachment— which provides proper amount of coolant for Resinoid bonded diamond wheels used for chip-breaker grinding. Prolongs wheel life and efficiency.

Specifications
Maximum length that can be ground —13½"; Maximum width that can be ground—6"; Maximum space under 7" wheel to table—9½"; Maximum space under 7" wheel to B & S No. 510 Magnetic chuck—6"; Table surface 5¾"x12".

DELTA
MILWAUKEE

The Army-Navy "E" —awarded for excellence in the production of machine tools vitally needed in the war effort.

Send Coupon for Full Details

Send for catalog giving full details and prices on the new Delta Chip-Breaker Grinder—and also showing full line of Delta drill presses, band saws, abrasive finishing machines and other Delta low-cost machine tools. Get in touch with nearest Delta Industrial Distributor or send coupon.

The Delta Manufacturing Company
610-F E. Vienna Ave., Milwaukee, Wis.

Gentlemen: Please send me your new catalog giving full details and prices on the Delta Chip-Breaker Grinder and your full line of low-cost machine tools.

*Name*_____

*Address*_____

*City*_____ *State*_____

SUNNEN HONING Provides a finish of 2 to 3 micro-inches—

and at a Saving of 35% in time!

Battery of 6 Sunnen Precision Honing Machines in completely air-conditioned room — honing to .0001" tolerance.

Accuracy — and a super-smooth finish with a real increase in production which means a saving in cost. That's the record of the Sunnen "MA" Precision Honing Machine in the modern plant of the Fidelity Machine Company.

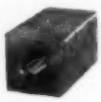
This one example is indicative of the many reasons why hundreds of leading manufacturers handling important war contracts have adopted Sunnen Honing.

Consider These Advantages

Wide range—handles internal diameters of .185" to 2.625". Accuracy within "one-tenth" guaranteed—has been held to .000025" on production jobs. Relieves big internal grinders for other jobs. Corrects errors of out-of-roundness or taper caused by previous operations. Facilitates duplication of sizes. Does not require skilled labor. Practical — inexpensive — economical to operate.

Put Sunnen Honing to work in your plant!

Aviation Hydraulic Cylinder made of Aluminum-Alloy. Improves the quality of the bearing surface. An extremely smooth surface-finish is secured.



Saved time in producing a smooth, accurate finish on this bronze remote control valve body.

Diesel Engine Fuel Injector Cylinder "So accurate that a piston can be fit within .00005 inch."

Aircraft Valve Tappet Roller. 4-Micro finish.

Bronze Valve. The Sunnen method of honing is used to secure a high finish and accuracy.

"Strict alignment maintained between two holes."

The coveted Army-Navy "E" waves over the Sunnen plant—evidence of the important part Sunnen equipment is playing in the war effort.

SUNNEN

SUNNEN PRODUCTS COMPANY — 7932 Manchester Avenue, St. Louis, Missouri

Canadian Factory: Chatham, Ontario

HOW METAL CHILLING KEEPS THE *Accuracy* IN PRECISION GAGE BLOCKS

COMPLETE STABILIZATION OBTAINED IN BLOCKS BY TREATING IN DEEPFREEZE —120° CASCADE CHILLING UNIT . . . . .

A prominent manufacturer of precision gage blocks was able to minimize expansion and warping of the blocks by chilling in a Deepfreeze —120° Cascade Industrial Chilling Unit. Deepfreeze sub-zero temperature is used to stabilize the blocks and maintain maximum Rockwell hardness by eliminating elevated drawing temperature after quenching and securing stress relief by bringing the blocks from room temperature to —120° F. six times during the final finishing operations. This complete stabilization eliminates costly metal growth and warp by holding the finished size under all normal temperature changes and handling.

Deepfreeze also used to speed manufacture of gages . . .

Heretofore the flatness of the lapping blocks used in the manufacture of these gage blocks was subject to a time distortion due to the release of strains and "ageing" of the metal which made it necessary to resurface them every two or three hours. Now by stabilizing through chilling in the Deepfreeze, the plates retain their accuracy for two or three days...or *2000%* increase in number of blocks lapped between resurfacing of lapping plates.

DATA AND PART INFORMATION

REQUIREMENTS...
Stabilize precision gage blocks. Also to stabilize lapping plates and face plates.

FORMER METHOD...
Formerly used dry ice, but could not obtain uniform results. Dry ice costly and difficult to use.

DEEPFREEZE METHOD...
Gage blocks were chilled in Deepfreeze Cascade Unit at —120° F. six times during final finishing operations. Chilled 4½ to 5 hours in Deepfreeze—1½ to 2 hours to bring to room temperature.

RESULTS...
Complete stabilization of blocks, eliminating costly metal growth and warp. Also lapping plates now hold accuracy for two or three days.

HOW YOU CAN USE DEEPFREEZE

In addition to preventing the growth or warp in gages and precision parts, Deepfreeze metal chilling can help you in: (1) The Shrinking of Metals for Expansion Fit (2) Treating of Tool Steel (3) Storage of Annealed Aluminum Alloy Metals (4) Testing of Aircraft Instruments and Materials. Deepfreeze Engineers are available to assist you in these and other metal chilling applications to your products. Send for preliminary calculation and test—no obligation.

FREE BULLETIN
describing Deepfreeze Units with complete details and specifications, and listing other uses. Send for copy today.

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Speed up Production

WITH THIS NEW Sav-way MODEL M-H-2 INTERNAL GRINDER

OFFERS both hand and hydraulic table operation . . . each independent of the other . . . a new and exclusive Sav-way feature . . . permits use of both hand and hydraulic feed in combination on the same job in the same setting . . . other special features that help speed up production . . . send for literature giving details and complete specifications.

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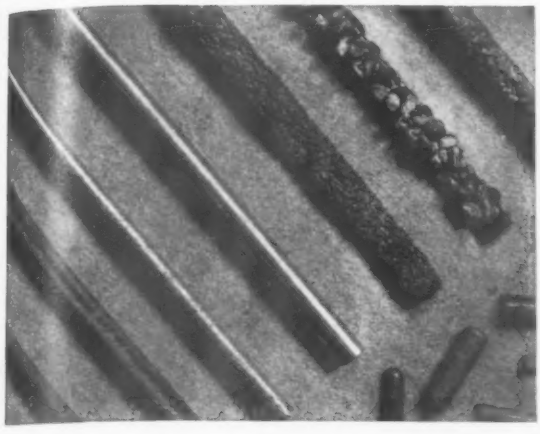
HAYNES STELLITE RODS—*For Every Type of Hard-Facing Application*



Available in most sizes and types for essential uses

What Hard-Facing Is—Hard-facing is the process of welding on to wearing parts a protective coating, edge, or point of a hard metal. This procedure makes critical parts of machines and equipment last from 2 to 25 times longer. Haynes Stellite Company has a rod for every type of hard-facing application.

Types of Rod Available

Haynes Stellite Rod—the original non-ferrous cobalt-chromium-tungsten hard-facing alloy — available in three different grades — high in "red hardness," highly resistant to abrasion and corrosion—applied by oxy-acetylene or electric-arc process.

Hascrome Rod — iron-base hard-facing rod containing chromium and manganese — work-hardens under impact — applied by oxy-acetylene or electric-arc process.

Haynes Stellite "93" Rod—iron-base hard-facing alloy containing more than 40 per cent of alloy ingredients—hard and abrasion-resistant—applied by oxy-acetylene or electric-arc process.

Haystellite Inserts — cast tungsten carbide in 13 standard shapes and sizes — extremely resistant to abrasion — generally applied by oxy-acetylene process with high-strength steel rod as binder.

Haystellite Tube Rod — tungsten carbide grains of 9 standard screen sizes in high-strength steel tubes—extremely wear-resistant —applied as hard-facing rod, generally by oxy-acetylene process.

Haystellite Composite Rod — tungsten carbide grains of 4 standard screen sizes distributed in high-strength steel binder — extremely wear-resistant — applied as hard-facing rod, generally by oxy-acetylene process.

Write for descriptive literature on the types of hard-facing materials in which you are interested.

HAYNES STELLITE TRADE MARK

HAYNES STELLITE COMPANY

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HARD-FACING RODS FOR EVERY PURPOSE

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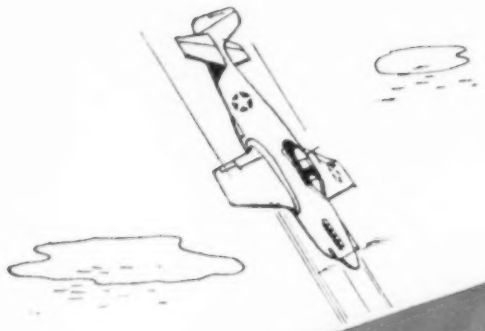
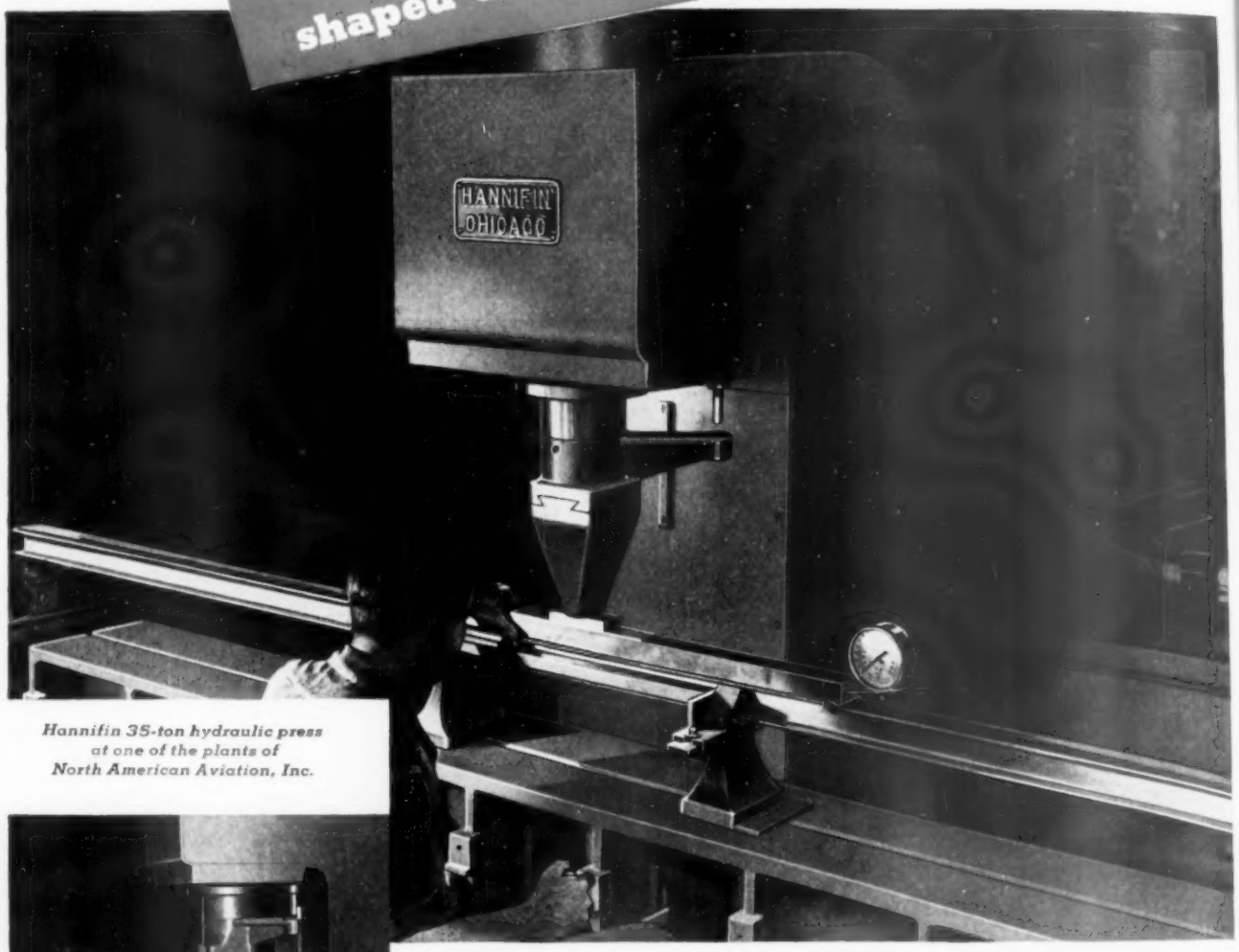


Mustang fighter longerons are shaped on this Hannifin Press



Hannifin 35-ton hydraulic press at one of the plants of North American Aviation, Inc.

HANNIFIN
Hydraulic **PRESSES**

North American Aviation, Inc., builders of bombers, trainers, and the famous Mustang fighter airplanes, uses Hannifin hydraulic presses for precision forming operations. The press shown here is being used for contouring a longeron of the Mustang fighter. Fast, accurate performance on exacting operations like this is the natural result of Hannifin hydraulic press design. The exclusive sensitive pressure control gives the operator any ram pressure needed, from a few pounds to full press capacity, at a finger-tip touch of the single-lever control. Pressure exerted by the ram is infinitely variable and proportional to control lever movement. This control is so simple and natural that operators easily maintain high production rates and consistently accurate work.

Hannifin hydraulic presses are built in many standard types, capacities 5 tons to 200 tons, for forming, straightening, press-assembly, and similar operations. Modifications are readily made in reach, gap, stroke, and table design to meet individual needs. Consult Hannifin engineers for specific recommendations.

HANNIFIN MANUFACTURING COMPANY
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PRODUCTION PERSPECTIVES

T.M. REG. U.S. PAT. OFF.

Production: Cutbacks in new facilities, machine tools and certain ordnance materiel, predicted here, are being effected; but overall production totals continue to rise. Final March figures indicate an increase of 11 per cent over the previous month and the necessity for stepping up certain lines. Aircraft, up 11 per cent, totaled 6,200 units. Ground Ordnance rose 7 per cent. Navy and Army vessels increased 14 per cent, while Miscellaneous Munitions rose 12 per cent.

Aircraft: This is the big job for 1943. If you're in the aircraft picture, the pressure will increase. Heavy bomber production has passed 500 monthly, and cargo ship output is up. But monthly production must average 9,000 planes for the rest of the year to meet the revised goal of about 75,000 planes....Materials, machine tools and manpower will be at a premium....Ships: One of the two most vital spots in war production, shipbuilding continued to rise. April witnessed all merchant ship construction shattered with the output of 157 vessels....In Short: The U. S. is over the top in the Battle of Production. Monthly totals of war materiel is now 5 times that of the pre-Pearl Harbor month. The period of "tooling" has passed. The period of "manufacturing short cuts and production ingenuity" has arrived.

Expansion: Building for "everything and anything" came to an end last month with 96 per cent of shipbuilding and 93 per cent of aircraft plants under Federal ownership....The WPB did not order plant expansion and machine tool building stopped; it merely said no new purchases will be authorized until it has been conclusively proved that the work cannot be done by existing facilities. Actually, about 60 per cent of the plant expansion this year will go into machinery compared with 45 per cent last year.

Materials: Consensus is that it will be a tight squeeze but that there will be sufficient material to meet the aircraft production goal this year. Such material will be spread among 30,000 manufacturers....WPB has revised downward to 91,000,000 tons its goal for 1943 iron ore movement on the Great Lakes. This does not indicate a lessening need for steel. Late opening of navigation was the reason.

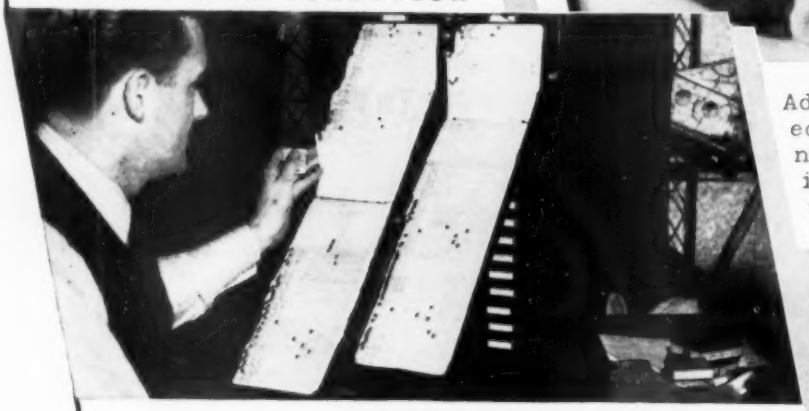
Machine Tools: As builders begin to see the bottom of the 6 to 9 months order banks, revealed here in March, many are turning to aviation and shipbuilding parts subcontracting where shortages are most critical. Orders—not production—are slumping. Output remains close to the all-time high and pressure to make deliveries has eased little. Backlog of orders still totals $500,000,000....Export: Value of machinery and equipment shipments by Lend-Lease from March 1941 through the same month this year totaled $370,655,000....Russia currently is a large machine tool export market. The Soviets also offer the best post war market yet seen. In visualizing such markets, builders must look for future development of mass production industries....Current Opinion: By producing in 4 years all the machines needed for war production, the industry has virtually deprived itself of a domestic market for 10 years after the war says Alexander G. Bryant....His opinion is shared by many National Machine Tool Builders Association members.... Notably opposed to the grave-digging theory is Joseph L. Trecker, who looks for a post war business 4 to 5 times its pre-war output. He believes many of today's tools will be uneconomical and unsuitable for post war product manufacture. His advice to worried colleagues: "The future of the machine tool industry is no blacker than the individual abilities of its members will allow it to be."

FOR *Best* *Results* FROM GAGES

TEST THEM FREQUENTLY

Adequate checking and measuring equipment, with provision for needed repairs and adjustments, is indispensable to proper maintenance of your gaging system.

KNOW THEIR CONDITION

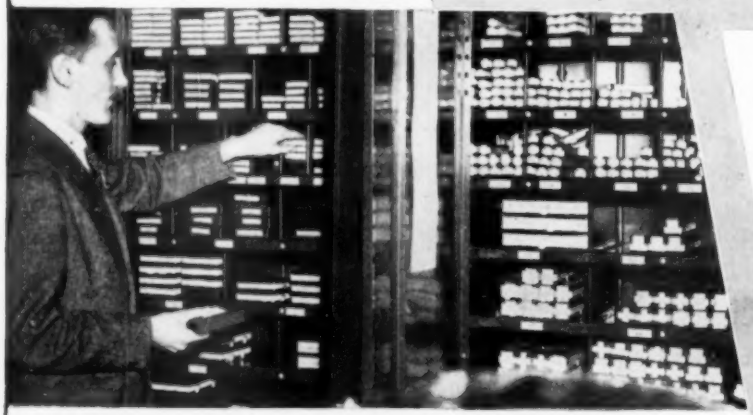


An adequate accounting system indicates exactly the present condition of your gages, shows when they were last checked, warns when new gages should be ordered.

Photos courtesy Republic Aviation Corp.

Just what gaging system you should have depends upon the set-up of your own plant. But the experience of many plants shows the value of due regard to the three features illustrated on this page.

PROTECT THEM BETWEEN JOBS



Determine the method best adapted to your plant which assures safe storage for gages while not at work. In the tool crib shown here, gages are replaced, and sealed in their original packages, after each job.

Adequate testing of gages, safe and convenient storage, and accurate records of their use and condition — these are the three essentials to keep in mind. Planning for these with care will pay you well in better size control of your product.

• • •

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Tool Conservation Begins in the Tool Crib

Precision Forging Pinion Gears

Saving critical machinery, material and cost, Timken-Detroit's forging and coining process produces a gear of greater strength.

R. J. GOLDIE
VICE-PRESIDENT
THE TIMKEN-DETROIT AXLE COMPANY

THE NEW Timken-Detroit process for coining differential pinions is recognized as one of the most revolutionary developments in gear making in recent years.

In our case it has been the means of saving more than 1,500,000 pounds of high grade steel annually on two pinions alone, plus thousands of man- and machine-hours and a tremendous investment in hard-to-get gear cutting machines. Figure 1 shows a comparison of the weight of steel formerly used in generating the smaller of the two sizes of high traction pinions, and the weight of steel now used in forging and coining the same size pinion. The saving on the smaller size amounts to .73 pounds per pinion, in that the bar stock weighed 1.65 pounds, whereas the weight of steel for the coined pinion is .92 pounds. On the larger size, the saving amounts to 2.65 pounds.

The differential pinion under consideration is not the usual type of pinion, but is of considerably coarser pitch and of a different tooth form than the ordinary differential pinion with the involute tooth form. (See box, "How Timken-Detroit Differential Gears Differ from Conventional Design.")

In normal operation an axle differential compensates for variations

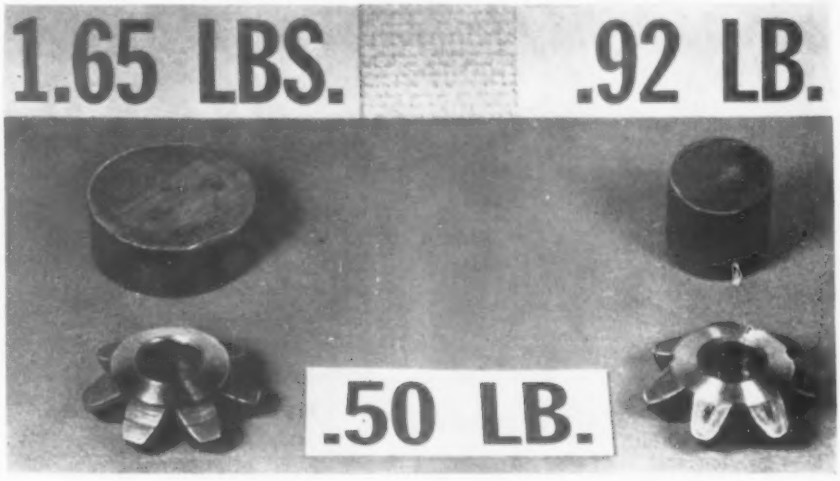
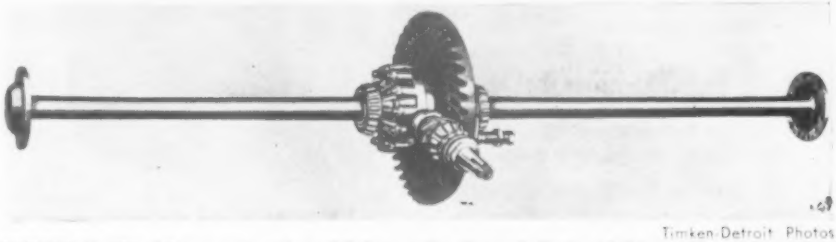


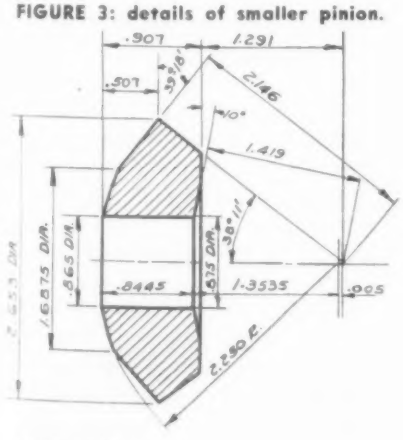
FIGURE 1: savings in steel are effected by new process.



Timken-Detroit Photos

FIGURE 2. Working parts of a driving axle, from left to right: axle shaft which transmits engine torque to left wheel; the differential; the bevel pinion which drives the bevel gear; the bevel gear, riveted to the differential case; and the shaft which transmits torque to the right wheel.

FIGURE 3: details of smaller pinion.



in speed between the outer and inner wheel, as when rounding a turn and it equally divides the torque input between the two driving axles.

The greater number of pinions necessary to the manufacture of Army vehicles is indicated by the fact that four pinions are required for each driving axle — and military vehicles today are all-wheel-drive vehicles for the most part.

Heretofore our high traction differential pinions in both sizes have been produced on Modified Gleasons in which a cam developed by our Engineering Department was mounted to actuate the cutting tools in the development of the required tooth form. These machines were specially made and it was impossible to get additional machines in time to meet vastly increased schedules when war seemed imminent—long before Pearl Harbor.

There have been numerous attempts to hot roll or hot forge gear teeth in the past, but I do not know of any commercially successful development until the Timken process was developed in 1941.

Either because of variations in the dies or rolls from a cold die to a heated die or roll, or because of excessive wear on the dies or rolls from scale, or because of scale on the teeth, the accuracy of form and surface necessary in gears running within close limits of backlash apparently was not attained in commercial production.

Early in 1941, I had conceived the idea of coining pinions in a Maxipress manufactured by the National Machinery Company. Our press was a No. 6 weighing approximately 300,000 pounds and of about 2000 tons capacity — probably larger than was needed for the operation, but of as-

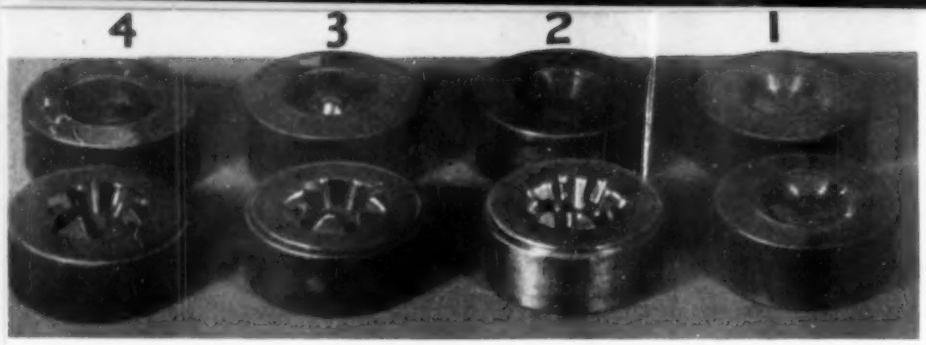


FIGURE 4: the pinion forging dies.

sured rigidity for the proposed experimentation.

The manager of our Forge Division, Mr. C. L. Wilber, took up the experimentation necessary to develop the process.

We had chosen to work out the coining process on the pinion rather than on the side gear because:

(a) There were double the number of pinions required, and volume was essential to justify the expense.
(b) When field failures occurred, the pinion usually was the offender, and we had proved in service that a forged pinion greatly increased the strength over pinions from bar stock. We felt the process of coining would materially increase the density of the steel and further improve the strength.
(c) The dies were less costly from an experimental standpoint on the pinion than they would have been on the side gear.

To save as much material as possible, we started with a pinion having a hole pierced through it in the forging process with enough stock left for finish machining the bore.

This approach was abandoned because in the coining operation the metal was forced back into the pierced hole rather than into the pinion tooth cavities of the coining die.

Experimenting with a solid pinion, we were able to force the material into the tooth cavities, but either the flash at the contour of the heel of the tooth was so heavy as to distort the

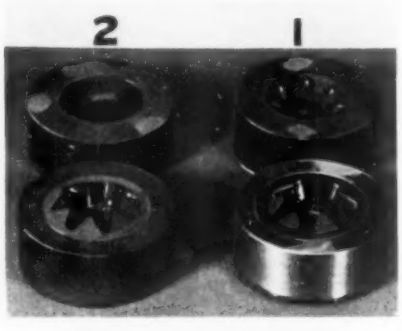


FIGURE 5: the coining dies.

FIGURE 6: the die reinforcement.

tooth, or if we reduced the flash to reasonable thickness, the coining die would burst. Attempts to coin the pinion cold had been abandoned long since and were coining at a temperature of 1200° to 1500° F.

We next tried putting a cup-shaped depression in the center of the spherical radius at the back of the pinion, hoping this would give a place for the metal to flow in coining. This failed because the metal apparently would not flow fast enough to prevent die breakage. It might be well to explain here that the Maxipress we were using had a reciprocating ram weighing eight tons and, continuously operated, runs at the rate of eighty strokes per minute, so that the action is more of a blow than a pressing operation.

All of these experiments (performed whenever the Maxipress could be spared from production) involved months of experimentation in die manufacture and design and variations in heating. We had, however, produced perfect pinions so far as size, contour and tooth form were concerned. The disappointing thing was that we could not get more than 10 to 50 pieces before the die would either burst or start to wash at the point facing the flank of the tooth.

Our dies, although having a strength of 200,000 pounds per square inch, were not standing up. The solution lay in reducing the pressure by some means so that the pressure would be high enough to properly form the tooth and low enough to prevent washing or bursting the die.

Solving the problem

There had to be some place for the displaced material to go instantly. The thin flash desired cooled so rapidly we could not depend on forcing the excess metal out through the flash without jeopardizing the die.

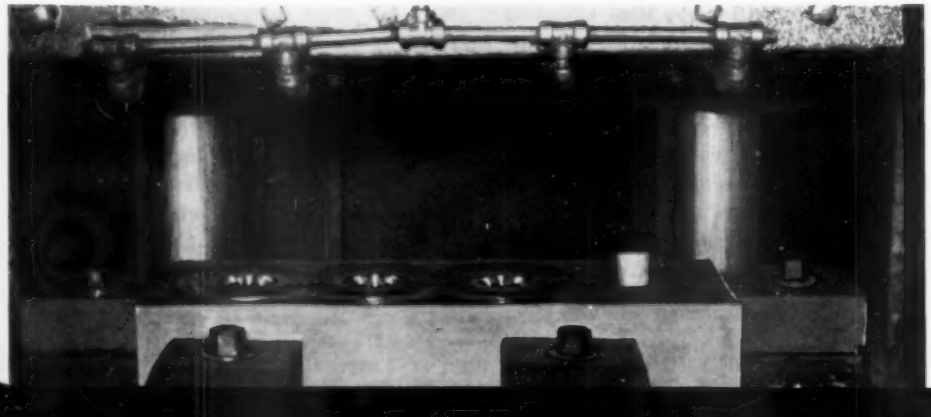
We hit upon the idea of leaving a depression in the back face of each tooth of sufficient area to absorb the metal displaced in the coining of the tooth and this proved, after some experimentation, to be the solution. All this sounds simple, but we had additional troubles to overcome.

First, a variation in coining dies was overcome eventually by making a theoretically perfect type cut on the Modified Gleason to which the coining dies were accurately fitted.

We thought the teeth were distorting in hardening after the coining operations, and made types and coining dies to allow for this distortion, only to find that the assumed distortion was a fine scale, which, when removed in a light pickle operation, showed a different reading on the checking fixture.

Then, while a beautiful surface showed after coining, subsequent pickling and carburizing operations left too rough a surface when scale was removed. A satisfactory surface

FIGURE 7. Upper and lower bolsters in place in forging press. Slug in die at extreme right is ready for upset.



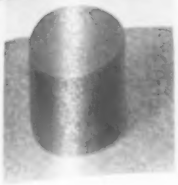


FIGURE 8-a.
Bar stock slug.

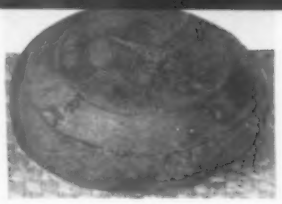


FIGURE 8-b.
Upset slug.

FIGURE 8-c.
Rough forging.

FIGURE 8-d.
Trimmed.

FIGURE 8-e.
Semi-coined.

FIGURE 8-f.
Finish-coined

FIGURE 8-g.
Inspection.

was obtained by removing all scale by sand blasting between the forging and coining operations, and then using a fine abrasive for light sand blasting after coining.

Heating, it was discovered, had to be uniform in the coining operations for uniform results, and we have not yet developed this phase of the work as far as we intend to go.

Early in 1942, we made a run of 5000 pinions, making an accurate check on every 100th pinion from the coining dies, and found no appreciable variation between the first pinion and the 5000th. We have finished, to date, nearly ½ million of the small size. Our rejections during the past three months have been less than 1/5th of one per cent.

We are getting 12,000 to 16,000 pinions from forging dies. We are getting 18,000 to 20,000 pinions from coining dies. The cost as compared with semi-forged and cut pinions has been reduced 10.2 per cent; 44.2 per cent of the original weight of steel is also saved.

We have also finished over 100,000 of the No. 2 pinion, a much larger and heavier pinion. Forging die life on the No. 2 pinion is from 8,000 to 10,000 pinions. Coining die life is from 15,000 to 16,000 pinions. We have reduced the cost of this No. 2 pinion by 18½ per cent—steel saved amounts to 55.5 per cent. Scrap has been 2½ per cent but will be reduced to less than 1 per cent.

Now, let us consider in greater detail, the pinion, the dies and the manufacturing process as in operation today. Specifications applying to the No. 1 or smaller of the two high traction pinions call for seven teeth—12 teeth in mate—the pitch is 3.27—and the high traction pressure angle is 25°. A detailed drawing of the No. 1 pinion is shown by Figure 3.

The pinion forging dies eventually developed are shown by Figure 4. The dies in the back row are the upper dies, while those in the front row are the lower dies. The dies at the extreme right, labeled No. 1, are those which receive the heated slug and upset it. No. 2 dies receive the upset slug and semi-forge the teeth. No. 3 and No. 4 dies are alike and finish forge the teeth, these dies being used alternately to prevent over-heating. Fewer than three strokes in the forging process required an impossibly fast flow of the metal, while more than three strokes were unnecessary.

After the three-step forging process the pinion is trimmed to remove the flash, following which it is coined in the two dies shown by Figure 5. The dies labeled No. 1 semi-coin the pinion and form the depression in the back of each tooth which was the answer to coining die life. No. 2 dies perform the finish-coining operation.

One of the secrets of getting so many pinions from each set of dies is found in the die reinforcement or

FIGURE 9.

MACHINING OPERATION SHEET

PINION No. 1 — COINED DIFFERENTIAL PINION

OPERATION NUMBER	DESCRIPTION OF OPERATION	TYPE OF MACHINE USED
1	Pickle	Pickle Tank
2	Shotblast (use fine grain)	Tumblast
3	Inspect for scale & forge marks	Bench
4	Cold Trim Flash	Trimming Press
5	Planishing	Hydraulic Press
6	Drill center hole	Hydraulic Multiple Drill
7	Finish bore, ream, chamfer & face spherical surface	Acme Turret Lathe
8	Grind burrs off back of (7) teeth	Angle Ext. Grinder
9	Chamfer & face inner face	S. S. Drill Press
10	String on wire & pack in carb. box	Floor Work
11	Load box in carb. furnace	Box Furnace
12	Unload furnace & quench in oil	Floor Work
13	Remove from oil & remove wire	Floor Work
14	Restring on wire	Floor
15	Load furnace & reheat	Bellevue Furnace
16	Unload furnace after reheat, quench in oil & remove from tank	Furnace & Tank
17	Wash & draw	Tank & Homo
18	Remove from wire	Floor
19	Shotblast (use fine grain)	Tumblast
20	Test hardness	Rockwell Tester
21	Grinding the bore	Heald Size-o-matic
22	Grind spherical surface	Norton Radius Grinder
23	Inspect by operator	Rolling Fixture
24	Inspect (match with side gear)	Balling Fixture

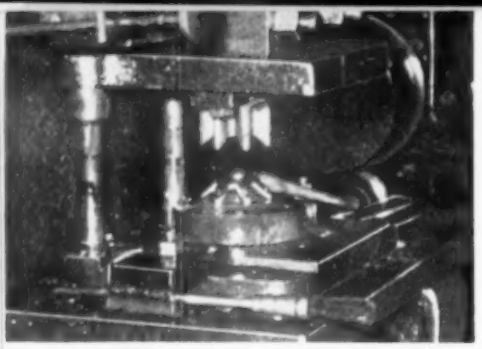


FIGURE 10. Trimming flash after the final coining operation.

HOW TIMKEN-DETROIT DIFFERENTIAL GEARS DIFFER FROM CONVENTIONAL DESIGN.

● An inherent fault of the ordinary axle differential is that torque delivered to two wheels operating from the same differential will be no more than twice that going to the wheel with the least tractive ability. In other words, when one of the driving wheels encounters a condition of relatively no frictional resistance, such as ice, only enough torque will be delivered to that wheel to drive it. The differential, being in its nature a compensator, transmits only a like amount of torque to the second driving wheel.

Timken-Detroit has designed a differential, taking no more space than the conventional mechanism, but with a gear [illegible] design which provides for a variation [illegible] leverage accomplished by automatically [illegible] the pitch radius. The result is a tooth [illegible] coarser pitch. Conventional bevel gears [illegible] a leverage ratio of 1 : 1 at all points of tooth contact. Timken-Detroit high-traction gearing has a variable ratio from 1 + [illegible] through 1 : 1 to 1 : 1 +. This ratio of the leverage change in the gear set can be varied to suit particular conditions. In the differential under discussion, leverage is 1.4 to 1. Because the Timken-Detroit high-traction differential gear teeth are normally fewer in number, they are larger and stronger.

shown by Figure 6. It resists any tendency of the dies to spread or break and of course contributes to the extreme accuracy of the finished pinion, whether it is the first or the 10,000th produced by the dies. The die proper is inserted in the reinforcement by a light press fit.

After the die has been inserted in its reinforcement, the assembly is inserted in a bolster which is keyed into either the ram or bed of the forging press.

Figure 7 shows the upper and lower bolsters in place in the forging press, ready to begin a run of pinions. Close examination shows a slug in the die at the extreme right, ready to be upset.

Concerning the type and cost of equipment used, our Maxipress cost about $83,000 installed. However, the work could be done on a No. 4 Maxipress costing approximately $41,000. Capacity on the No. 1 or smaller pinion is 320 per hour sustained production. Capacity on the No. 2 or larger pinion is 250. Further development of heating and handling will step the No. 2 pinion up to approximately 300 per hour. To generate the same number of pinions per hour would require 19 special machines costing approximately $266,000 and space requirements would be approximately 100 per cent greater.

The only other items of equipment required are a controlled heat furnace costing $6,000 installed and a No. 12 Erie Trimming Press costing $3,500 installed. All three items of equipment come to a total installed cost of $50,000.

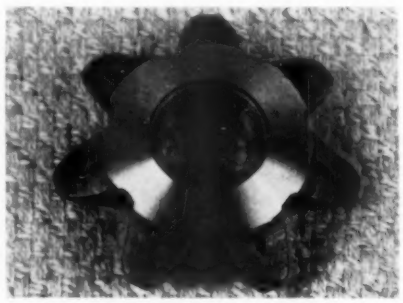


FIGURE 12. The pinion following final machining. This shows how depressions formed by semi-coining are almost entirely filled in finish coining.

The forging and coining operations, in order, are: 1—Shear stock to length. 2—Upset, break down, and finish forge. 3—Cold trim. 4—Pickle. 5—Shot blast. 6—Semi-and finish-coin. These operations are shown in Figure 8.

In Figure 8-e, showing a semi-coined pinion, is seen the thing that contributed most to the eventual success of the new process—the depression in the back of each tooth. As previously explained, these depressions give the metal a place to go when finish coining is performed, thus avoiding cracking and washing of the die. Also note the smooth tooth surfaces and the small amount of flash produced.

Three forging and two coining operations produce a finish-coined pinion (Figure 8-f) with tooth surfaces so smooth that absolutely no machining of them is required. Comparing these comparatively quick and simple operations with the longer, more complex operations involved in generating a pinion to this stage sharply illustrates the advance in gear making the new process represents.

Following finish-coining comes inspection and checking of the pinion by means of the GO - NO GO gauge shown in Figure 8-g. Each 100th pinion is checked.

Subsequent machining processes were developed by our Master Mechanic, Mr. S. C. Probert, and Chief Tool Designer, Mr. H. E. Kraning. The technique of correlating the forging, cleaning, machining and hardening activities has been under the direction of one of our able foremen who has an excellent background of tool and production experience, Mr. George Martin, who was directly assigned to following through the production processes and keeping the procedure under constant control.

This is essential in a process of this kind where forging operations are so intimately tied up with subsequent machining operations. The machining processes shown are not our idea of the most efficient methods or machines for performing the operations described. Our Mechanical Division simply utilized available equipment

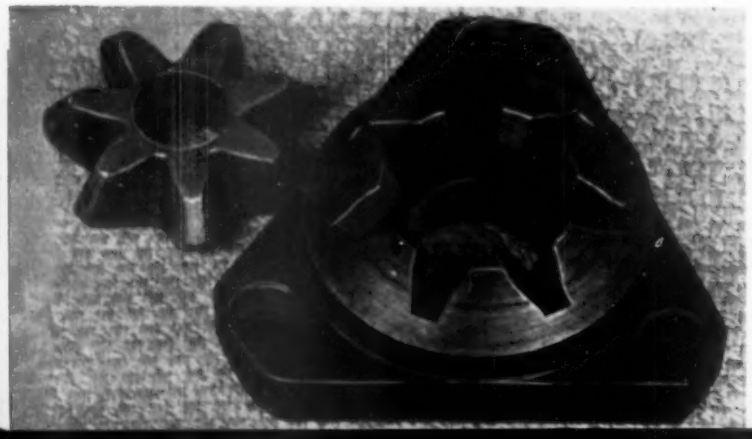


FIGURE 11.

Fixture for holding and centering the pinion in most of the machining operations.

and ad ed it to the work at hand because f the shortage of new machines der existing war conditions and be se we felt the need of putting ev y machine at work that it could r sonably do. Figure 9 shows the ma ining operations sheet for pinion No. 1, which is almost identical to the erations sheet for pinion No. 2.

Mac ining operation No. 4 consists of trim ing off the flash left after the finish-c ining operation. This is done on a trimming press, Figure 10.

Next step, planishing the teeth, imparts a slightly smoother finish. It is followed by boring the hole in the trimmed pinion on a hydraulic four spindle drill.

Operation No. 7, consists of finishing the bore, reaming, chamfering, and facing the spherical surface on an Acme turret lathe.

Figure 11 shows how the pinion is held and centered in most of these operations. A fixture duplicating the coining die form holds the pinion from the pitch line of the teeth.

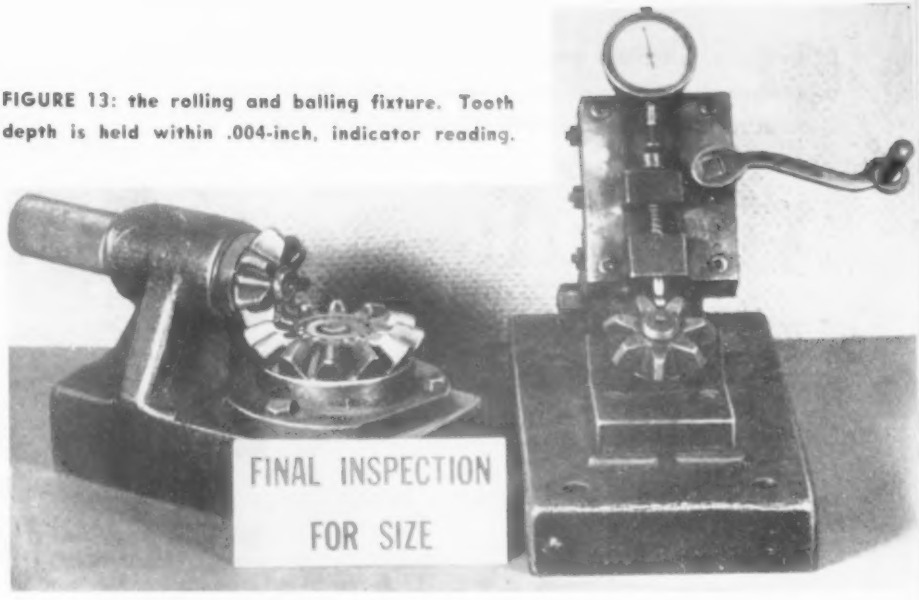
Figure 12 shows the pinion following final machining. This illustration also shows how depressions formed by semi-coining are almost entirely filled in finish-coining.

At this point the finished pinion is inspected—operation No. 26 on the sheet—using the rolling and balling fixtures shown by Figure 13. Tooth depth is held within .004 inch, indicator reading.

Aside from the saving in cost, equipment and materials already mentioned, this new process has further advantages for producing differential gearing. The first advantage is that we get an accurate reproduction of the theoretical form of tooth desired, as shown by the Figure 14 profile comparison. When preparing this figure we found that the actual and theoretical profile lines, which are 20 times actual size, coincided so exactly that we had to move the dotted line, showing the actual profile, a trifle to the left of the solid line showing the theoretical profile. There is a slight difference in the root of the tooth.

A second advantage is exact duplication of form—one pinion with another—while the third advantage is increased strength due to (a) greater metal density resulting from the forging and coining operations, and (b) no cutting across flow lines of steel. Examination of cross-sections show

FIGURE 13: the rolling and balling fixture. Tooth depth is held within .004-inch, indicator reading.



that the flow lines are such that the stress exerted on the pinion in service is at right angles to the flow lines rather than with them.

This is particularly evident in this cross section photograph of the No. 2 or larger pinion (Figure 15).

Pinions generated from bar stock, because of constant parallel grain, present surfaces subjected to stress with the grain. If greater strength were the only advantage gained by the new forging and coining process, the time and money put into the process would be well spent.

The question might be asked—can the process be further developed? There is no question that side gears can be produced by the same means and with equal advantages in cost and strength. The question might be asked as to whether the process might be used to produce gears such as automobile or motor truck rear axle drive gears which run at high speeds and in which the factor of reasonably quiet operation is essential. I doubt if a sufficiently high finished surface can be produced in this type of gearing, although we have done some work on improving the surface of the teeth by a cold planishing operation after the hot coining operation has been completed and the surface lightly sand blasted. I do not believe high speed gear teeth, where quiet operation is essential, are likely to be produced by this method alone.

I *do* believe it is possible—where there is sufficient volume to warrant the expenditure for the equipment and where the pitch of the gear is coarse enough to give sufficient body to the coin-dies—to produce gears with the teeth coined to an accuracy that will permit final finishing operations to be carried out on later type Gleason grinders. The Gleason Company has made remarkable strides in the development of spiral bevel gear and pinion grinders of either the generated or formate type tooth. If gears can be coined to an accuracy even approaching what we have accomplished, they could be carburized after coining and then finish ground, eliminating rough gashing and finish generating operations. This is a development where only large volume production would warrant the manufacturing equipment expense entailed.

We believe that with modern forging equipment many precision parts can be made in forging presses, eliminating expensive machine operations and not only equalling, but improving the resulting product.

THE END.

FIGURE 14 (drawing). Profile comparison with theoretical form of tooth desired.
FIGURE 15. Cross-section showing structure of the larger forged pinion.

Essentially, aircraft gears differ from other types because of extremely light sections, producing complex forms. It all adds up to complications in gear production.

Aircraft Engine Gears

PRODUCTION AND INSPECTION

CHARLES G. PFEFFER
WRIGHT AERONAUTICAL CORPORATION

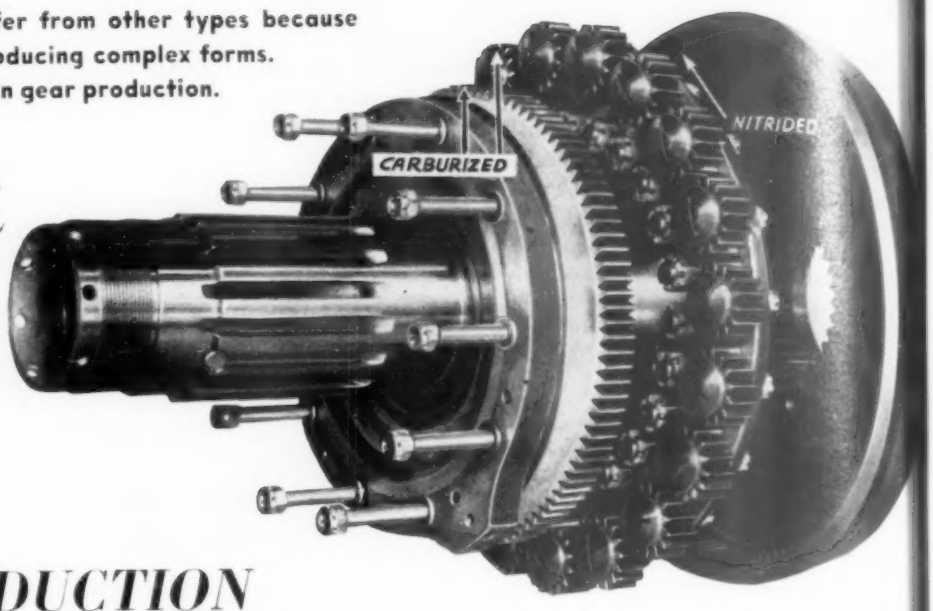


FIGURE 1. Planetary type drive. At take off, each pinion carries load of 80 hp., and each tooth is under maximum contact pressure of 120,000 psi.

THE most important aircraft engine unit is the reduction drive. In practically all modern aircraft engines, this is the direct connection between the power developed by the engine and the propeller.

Figure 1 shows the widely used planetary type drive using either bevel or spur gears as shown. In this particular case the large internal gear is the driver which rotates at engine speed. The 20 pinions are the driven members and are carried on the arm or propeller shaft. The center gear is the stationary member around which the pinions rotate. At take off each of these pinions carry a load of 80 hp. and each tooth is under a maximum contact pressure of 120,000 psi. The tangential load on each tooth is 372 lbs. The torque transmitted to the propeller by the complete gear train is 74,800 in. lbs.

The most important and essential difference between aircraft engine gears and the conventional type is in the extremely light sections employed, producing gears of many complex forms. With the heavy loads imposed upon many of these gears it is obvious that design is an important factor and such conditions as proper lubrication, vibration, deflection and bearing supports must be given careful attention.

Figure 2 showing a section of a cam drive gear, in which the relation between the large and small gear must be maintained, illustrates design and production complication.

Figure 3 shows a sectional view of a large reduction gear. The internal teeth are approximately 20 inches pitch diameter. The teeth in the center section form the spline which locates the gear on the driving shaft. The extremely light web has a definite purpose and is to permit flexibility under load thus insuring proper alignment of the gear teeth and to compensate for distortion of the engine due to heat and propeller torque.

Another complex example includes a zerol bevel gear, spur gear and two internal splines. The root angle of the bevel must clear the outer rim for machining and the splines are of different tooth numbers necessitating machining from each end.

ALL TYPES OF GEARS

The major portion of the gears in aircraft engines are spur gears, particularly where any degree of power is to be transmitted. For other functions practically the entire range is covered — bevels, both straight and zerol, worm drives cone type, enveloping and conventional spirals, helicals and face type gears.

Gears such as these must be of high core strength and of hard wearing surfaces. All gear blanks are made of forgings with controlled flow lines and density for maximum strength. Forgings are normalized and annealed before machining. Gear blanks are machined to grinding size and carburized for a finished depth of case from .025 to .035. Forgings are made of steel similar to SAE-33-12 which produces a uniform case and a hardness of 60 minimum Rockwell "C". Usually machine operations are not inserted between carburizing and hardening. The complicated form of most aircraft engine gear blanks make it necessary to quench most of these gears in dies at the hardening operation. Nitralloy steel is used also for many gears. Large gears of light section made of this steel can be surface hardened with a minimum of distortion. Quenching dies are not required and the surface produced has great wear resistance. It is readily machinable in its annealed state.

In general preliminary manufacturing operations follow the usual procedure of shaping or hobbing. There are some exceptions however.

For example, Figure 4 shows the size cutter necessary to generate the internal gear of a cam. It is evident that the many revolutions necessary to complete the cut will introduce some unavoidable errors.

Where aircraft engine manufac-

ture differs mainly from the conventional procedure is in the finishing operations. The aircraft industry has demonstrated that small gears made as precisely as modern methods permit will safely carry the enormous loads imposed upon them and function unfailingly. The complex form of the many gears used has led the industry to adopt gear grinding as the finishing operation after the gear has completed the necessary heat treatment and hardening procedure. Thus it is possible to maintain reasonably close tolerances of the different elements which constitute good gears. Therefore approximately 80 per cent of all production gears for aircraft engines are finish ground.

GEAR GRINDING

Two types of gear grinders are used. The Pratt & Whitney gear grinder both single and double wheel are used extensively as are the Lees Bradner and Maag grinders. These machines are of the generating type in which the wheel is dressed to the form of a rack tooth. The gear is rolled under this wheel thus producing the involute form. The generating roll is controlled by master gears and racks or pitch blocks and bands.

The form grinding method uses such machines as Gear Grinding Machine and National Broach "Red Ring" Gear Grinder (Figure 5). Internal gears such as shown can be ground only on this type machine. External gears are also ground by mounting the wheel directly on the spindle instead of the extension bracket. The grinding wheel is dressed from a form template which controls the thickness and form. The wheel thus fills the tooth space and is traversed thru the gear and then indexed for the next tooth. This process is followed until the gear is ground to size. Indexing is controlled by a master plate. The accuracy of all ground gears depends greatly upon the condition of the controlling elements, such as master grinding racks, master gears, index plates and formers. The first requirement is that such tools must be accurately made and this condition must be maintained as closely as possible.

Surface finish produced by grinding may show a reading of 15 micro. inches.

Figure 6 shows an etched section of a pinion correctly ground. The carburized case is uniform throughout the entire profile and represents accurate production gear grinding. The full radius at the root fillet is the standard form of tooth used for aircraft gears. All cutting tools are developed to produce this full fillet. The purpose of this fully rounded fillet is to avoid any stress concentration at the root.

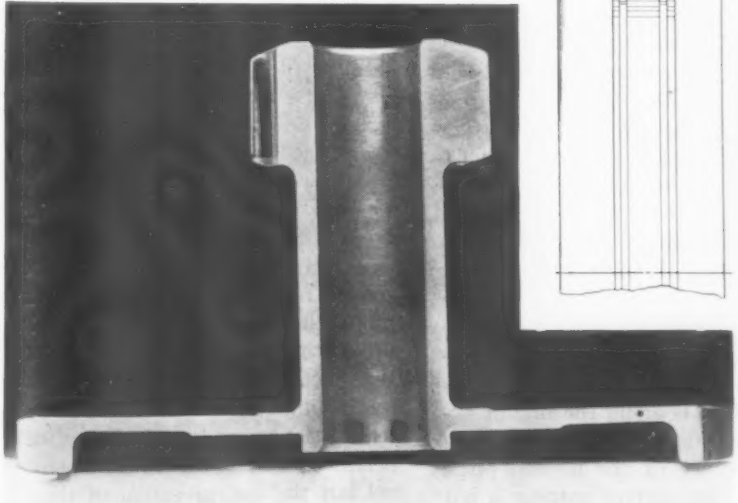
General practice is to lap all gears. Ground gears are lapped to remove the fuzz produced by the grinding wheels, to improve the surface finish and to remove any interference in the rolling action by revolving the gear against the lap.

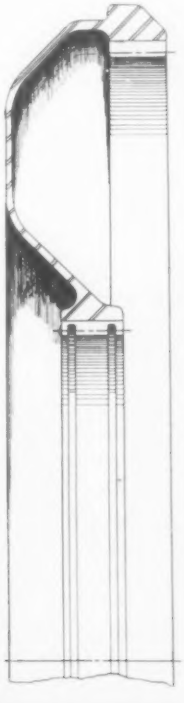
Figure 7 shows the Fellows Lapping Machine using the internal pair principle. The work is driven by the lap and automatic reversal causes both sides of the gear teeth to be finished. National Broach and Michigan Tool Machines employing the cross axis principle are also used. Lapping can and does produce a fine grain surface

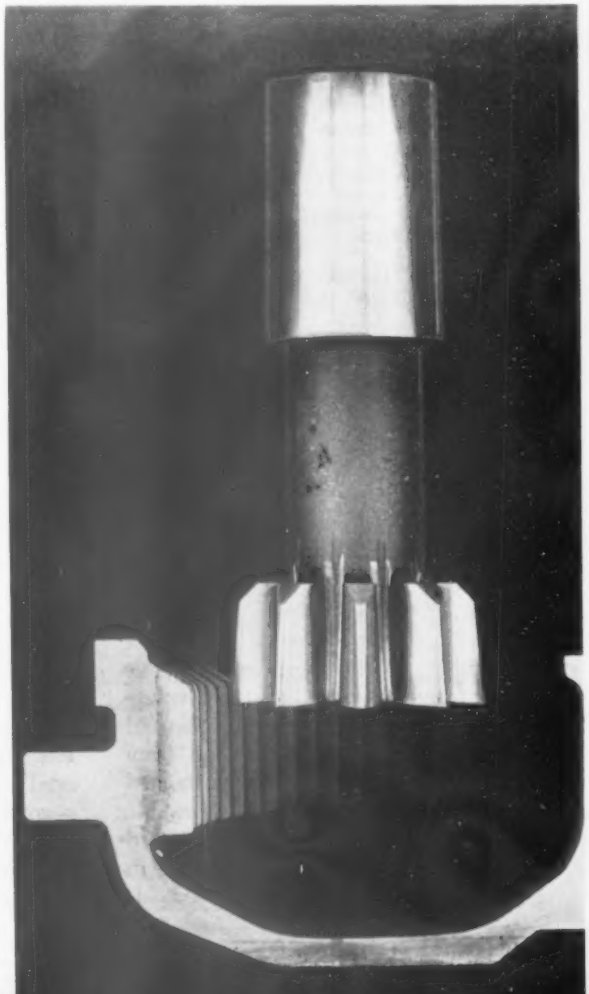
Below: **FIGURE 2. Section of cam drive gear. The relation between large and small gears must be maintained. Illustrates design and production complication.**

Right: **FIGURE 3. Sectional view of the large reduction gear. Extremely light web permits flexibility under load, insuring a proper alignment of gear teeth.**

Extreme right: **FIGURE 4. Shows size of cutter necessary to generate internal gear of a cam. Many revolutions necessary to complete cut introduces unavoidable error.**







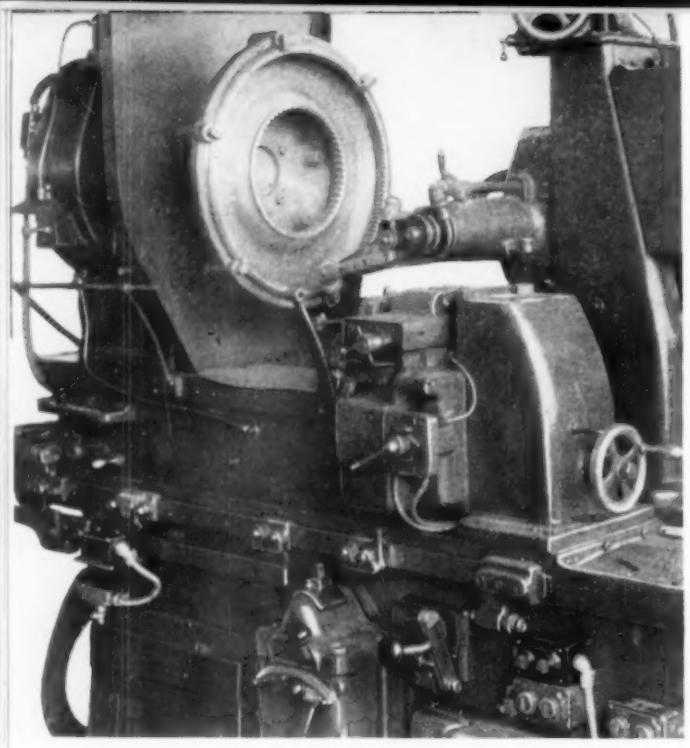
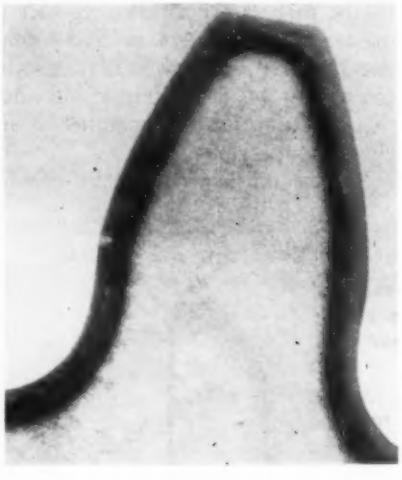


FIGURE 5
Internal gears such as shown can only be ground on this type of a form grinding machine. External gears are mounted directly on spindle, instead of on extension bracket.

Wright Aeronautical Photos

FIGURE 6
Etched section of a correctly ground pinion. The carburized case is uniform over the entire profile.



and will correct a small margin of error but it cannot be used as a medium for correcting poorly produced gears and excessive lapping can be extremely harmful. To detect any minute cracks in the surface of the gear teeth all parts are subjected to a magnaflux test.

The necessity of increased production due to the war effort and the vast expansion involved makes proper gear inspection assume a vital position.

For a spur gear, four basic elements should be checked and controlled:—

1—Tooth shape and involute form.
2—Tooth space or normal pitch.
3—Tooth thickness.
4—Eccentricity.

For the Helical gear another element is added, the Helix angle. To secure accurate measurements of these basic elements would seem a simple operation. Actually this is not the case and further analysis will show that the results are apt to be quite complex. Measurements are spoken of but these really are comparisons or relative readings.

CHECKING TOOTH FORM

An involute profile machine built by Illinois Tool Works is used for checking tooth form, a principle which involves unrolling the involute from the base disc or master form and a pointer traces the variation from the correct form. A recorder attached to the machine poduces a graphic chart which makes a permanent record of the reading. Thus it is possible to determine the correctness of the position of the involute in relation to the base diameter and the section of the involute curve used.

Any eccentricity of the gear or locating arbor will result in a misplacement of the tracing point and will indicate a non-existing form error. The point of the tracer must be exactly on center to give the true reading from the exact base diameter. The surface of the tooth being checked must rotate in the plane perpendicular to the axis. It is, therefore, evident that a number of readings must be taken to determine the average form. Tooth spacing and normal pitch are often confused. Tooth spacing is the distance from one tooth to the next measured at the pitch diameter whereas normal pitch is along the line of action. As conjugate action depends on the uniformity of the normal pitch it follows that correct spacing is not necessarily an indication of correct rolling gear but normal pitch.

The normal pitch measuring machine usually used is illustrated in Figure 8. This instrument can be set by setting the fingers to a calculated dimension, from a master gear, relative readings from tooth to tooth can be taken. The fingers are set tangent to the base disc and the lower member being fixed the upper finger actuating the indicator. Here again eccentricity of work or arbor will cause the fingers to contact at different diameters, errors of form will also cause variations which will be interpreted as normal pitch errors but actually are errors of related elements.

Tooth thickness is measured in various ways such as gear tooth verniers, micrometers over pins and vee blocks representing racks. All these methods are affected by one or the other of the following elements such as outside diameter, spacing, space width and involute form. The probability of these errors must be considered in arriving at a definite and conclusive result. The question of eccentricity while important is not as vital as the other tooth elements. Where gears run at high speeds, eccentricity will create noise but will run satisfactorily if sufficient clearance and backlash is present.

INSPECTION ON PRODUCTION

Eccentricity is checked by the pin and indicator method and changes noted at the point of contact. Obviously a gradual rise and fall of the reading will indicate eccentricity whereas abrupt changes indicate errors in spacing and profile. Pin diameter is of considerable importance, a small pin contacts below the pitch line where form errors cause large changes in pin location. The most accurate results are obtained by using a pin of the largest diameter possible. The same applies when a cone point is used instead of a pin. This method has some advantage as the line of action is always perpendicular to the side of the tooth. With the pin this line must pass through its center.

The tremendous increase in personnel required to meet expanding production schedules obviously eliminated the possibility of using inspection methods which require specialized training. The instruments can be readily set up and operated by inexperienced and newly trained personnel but the interpretation of the re-

sults must be based on experience. It is therefore, evident that gear inspection must be placed on a production basis to keep pace with the required schedules. To do this all probability of error must be eliminated wherever possible and means must be provided to expedite these operations retaining the exactness of the final result. How can this be accomplished? A brief review of the process and progress will show these possibilities.

A common method is to roll the gear on a fixed center fixture against a master gear of known proportions. In this case the large gear is the master and the pinion the work. The work is rolled thru the master and its freedom or backlash noted and checked. Such a check is of little value in detecting gear tooth errors, but it does prove that the pinion will assemble at this same center distance and show the existing backlash at such a center. This is of minor importance as the actual operating center distance is never as exact as the fixture and therefore has little relation to the operation of the gears under running conditions.

The procedure of the rolling check would be an advantage if it could be arranged to detect existing errors. This is possible on the Fellows Red Liner. In this test the gear is rolled against an oversize master metal to metal. The gear on centers is fixed and the master is on a fulcrum arm which operates the pen of the charting attachment. Thus is produced a composite check of all errors on the principle of such errors of form, spacing, eccentricity and variation of tooth thickness is converted into linear action when rotated and this relation is charted on the graph. Thus it is possible to produce a rapid and simple checking operation which is a positive indication of the gear tooth action. A similar machine is the Illinois charter.

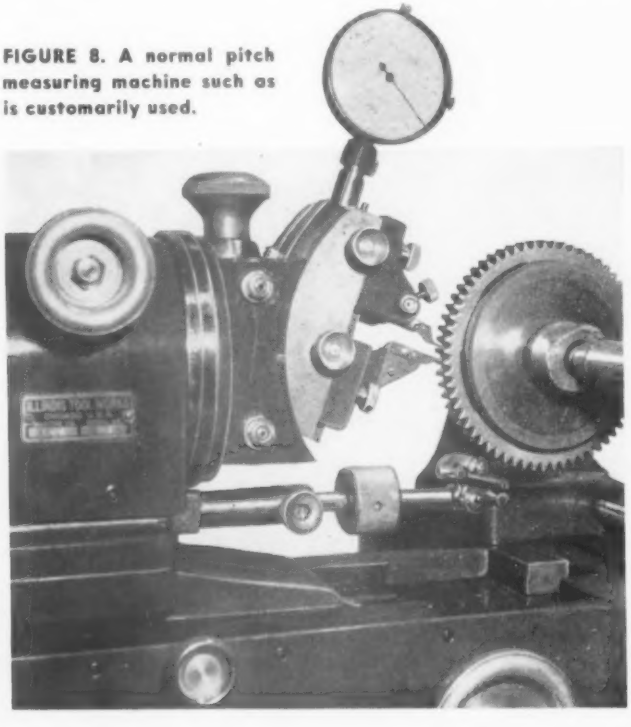
TOOTH BEARING

Another similar method is the indicating type fixture. This is based on the same principle as the Red Liner. The indicator replaces the charting mechanism and the tooth action is the variation of the indicator. Tooth action and eccentricity are indicated by the reading.

One important condition which has received considerable attention in the past few years is Tooth Bearing. It has been known under various applications such as sound testing and speeders. It is obvious that aircraft gears such as have been illustrated would create a resonance which would destroy the effectiveness of sound testing. But the importance of the bearing cannot be neglected. In conducting a bearing test one gear is driven by power and rotated against the mating gear or a master to which the breaking pressure is applied. A light film of red lead is used to show the bearing and indicates the slightest variation in the allied factors such as pressure angle, tooth form and spacing. It also gives a positive indication of the position and alignment of the bearing. One interesting note is the variation of the bearing produced without load and the application of load. Under load the bearing area spreads to its full extent and indicates the very slightest change in the gear teeth. This may be caused by the compression of the material or tooth deflection. At any rate it indicates that a bearing test without load is of no practical value. THE END.

FIGURE 7. Lapping machine using the internal pair principle. Work is driven by lap and automatic reversal causes both sides of teeth to be finished.

FIGURE 8. A normal pitch measuring machine such as is customarily used.



SURFACE FINISH OF GEAR TEETH

● An interesting point has been advanced concerning the wearing efficiency of relatively smooth gear tooth surfaces, as compared with highly polished surfaces. Fairly conclusive tests by a builder of aircraft engines showed that gears with slightly ridged (parallel to the axis of the gear) teeth outlasted teeth lapped to a finer finish. Actually the ridges could be detected by rubbing a thumb-nail across them. Explanation offered for this phenomenon is that less smooth surfaces, to a degree, will trap oil to an extent that permits more efficient lubrication. More metal to metal bearing resulted from smoother finish.

Studebaker Produces AIRCRAFT ENGINE GEARS

Representing an up-to-date catalogue of gear-cutting equipment, this plant has streamlined its operations from rough machining to final inspection.

JEROME WILFORD
ASSOCIATE EDITOR

PRODUCING 43 kinds of gears machining more than 60 combinations of gears and shafts, the Aircraft Engine Division of the Studebaker Corporation includes a highly integrated plant devoted entirely to manufacturing gears to specifications of the Wright Aeronautical Corporation. It presents one of the best opportunities of studying completely up-to-date gear production machinery and tools at work.

Starting at scratch, with all new machinery, a burden of responsibility has been placed on personnel all along the line. They are showing the capacity of both machines and themselves. All new equipment has produced further results. In some instances, it has permitted management, engineers and machine operators — more than in long established plants using older equipment — to determine the capabilities of equipment for particular jobs. It has made it possible for them to explore the limits of generally trouble-free machinery. Further, there is no tendency, as is evident and even necessary in some war plants, to make a new piece of equipment compensate for the age, loose operation and general deficiencies of other machinery. Machines are not generally burdened beyond design limits.

The entire plant is departmentalized according to operation, in effect a modern jobbing shop with high production results. It supplies assembly lines designed on the principle proved in automotive production.

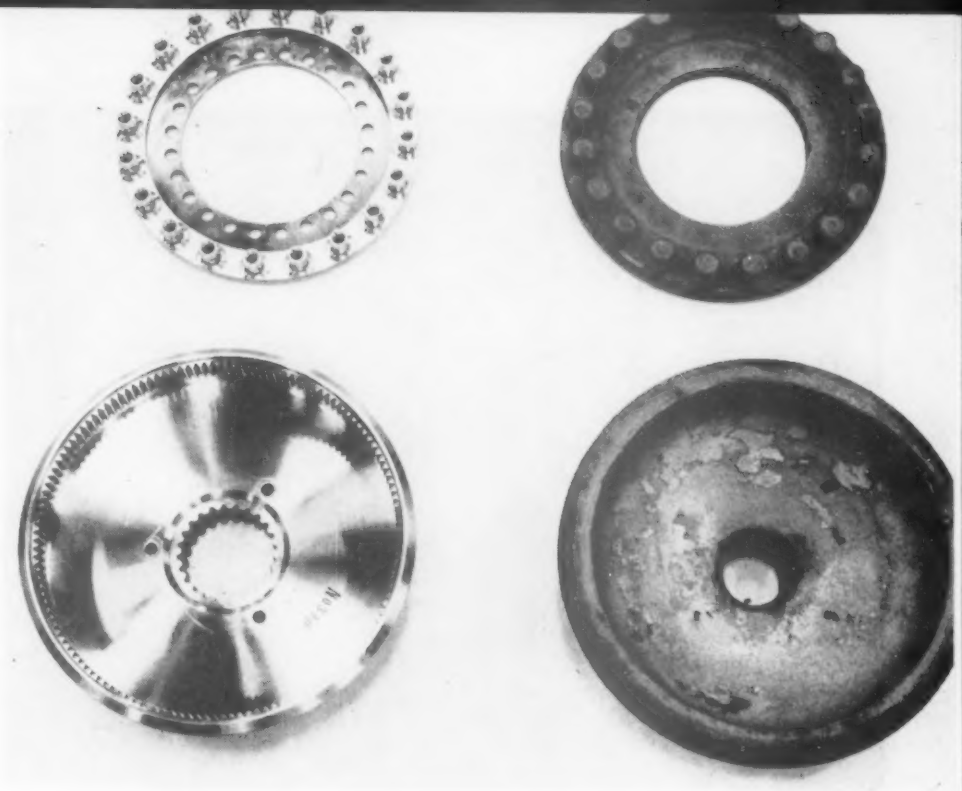
Parts are moved from department to department on dollies and hand trucks. Packed in wooden boxes or trays, each gear on a dowel so that it will not slide or fall against another gear and mar or scratch a surface in process, parts are moved back and forth across the plant, some thousands being always in this stage of production. Maintaining small inventories in the plant aids in relieving congestion or confusion. The entire operation on any part is well planned.

Studebaker Photos

A major share of production on aircraft gears consists of quality machining, other than actual gear-cutting. Here, a Leland-Gifford machine drills and reams 40 angular oil holes through trunnions on gear reduction pinion carrier.

INVOLVED SEQUENCE

Because of the nature of the product, demanding precise heat treat and finishing operations, manufacture of aircraft gears may require a highly involved sequence. Timing, perhaps more than any other factor, is important to a smooth running operation. On the typical assembly line set-up, timing is almost unavoidable, but once it is organized, little adjustment need be made. However, to introduce the same precision of movements to the departmentalized oper-



Reduction gear pinion carrier for Cyclone engine, together with forging from which it is machined, are shown in upper half of photograph. Entering the Studebaker plant, this forging weighs more than 31 pounds; 43 machining operations reduce it to less than 12 pounds.

•

Total of 38 machining operations reduce weight of 76-pound forging to little more than 20-pound finished reduction driving gear shown in lower half. This part has an internal spline of 24 teeth, an external gear (not shown) of 48 teeth and an internal gear of 135 teeth.

ation layout requires a high degree of planning from day to day, to meet changing production requirements, or in adjusting to variations in department efficiency. Before considering a typical sequence of operations on a particular aircraft gear, it might be well to have in mind certain operations, some not ordinarily associated with gearing, upon which particular emphasis is placed. This will help in evaluating the special problems which face an aircraft gear plant.

Most external gears, with the exception of spirals and bevels, are cut and ground. On spiral gears of certain kinds, Barber-Colman hobbing machines produce a finished part in one cut. Bevels may be produced without grinding or lapping on Gleason generators.

CAUTION AGAINST GRINDING BURNS

In grinding, particularly with the skilled labor problem presented today, extra care must be taken to prevent burning the gear teeth. Surfaces can be burned harmfully, though the appearance of burns, except under immediate inspection may be barely perceptible. In following machining, surface appearance may disappear, though the damage has been done.

Inspection of aircraft gears is both thorough and frequent. For 47 machining and processing operations on one part, 21 inspections are scheduled. This assures quality production, and it affords a saving in production by preventing further machining of a faulty part, and saves already performed production and material by catching imperfections while it is still possible to salvage the part.

Unusual emphasis is placed on polishing. In fact, as much as one-third of total machining time may be consumed by hand polishing, using pencil wheels operating at high spindle speeds and other conventional equipment. Enough material can be removed on these operations to exceed tolerances, if the operator is not sufficiently skilled.

With hand grinding and buffing tools, all edges are broken down, permitting no opportunity for a finished gear to score or tear in meshing, or for bearing surfaces to break down. Every edge is finished to a small radius. Blending adjacent surfaces in this manner is a preventative to fatigue failure.

Heat treating aircraft gears also received emphasis not usually accorded other gear production. To protect the fragile and frequently irregular shapes of aircraft gears, parts are generally quenched in dies which support sections subject to stressing. All gears, following final heat treat, are finish ground.

Relieved of any handicap caused by outmoded, or worn equipment, production engineers in this plant have been able to devote some attention to improving or selecting other than conventional methods of machining.

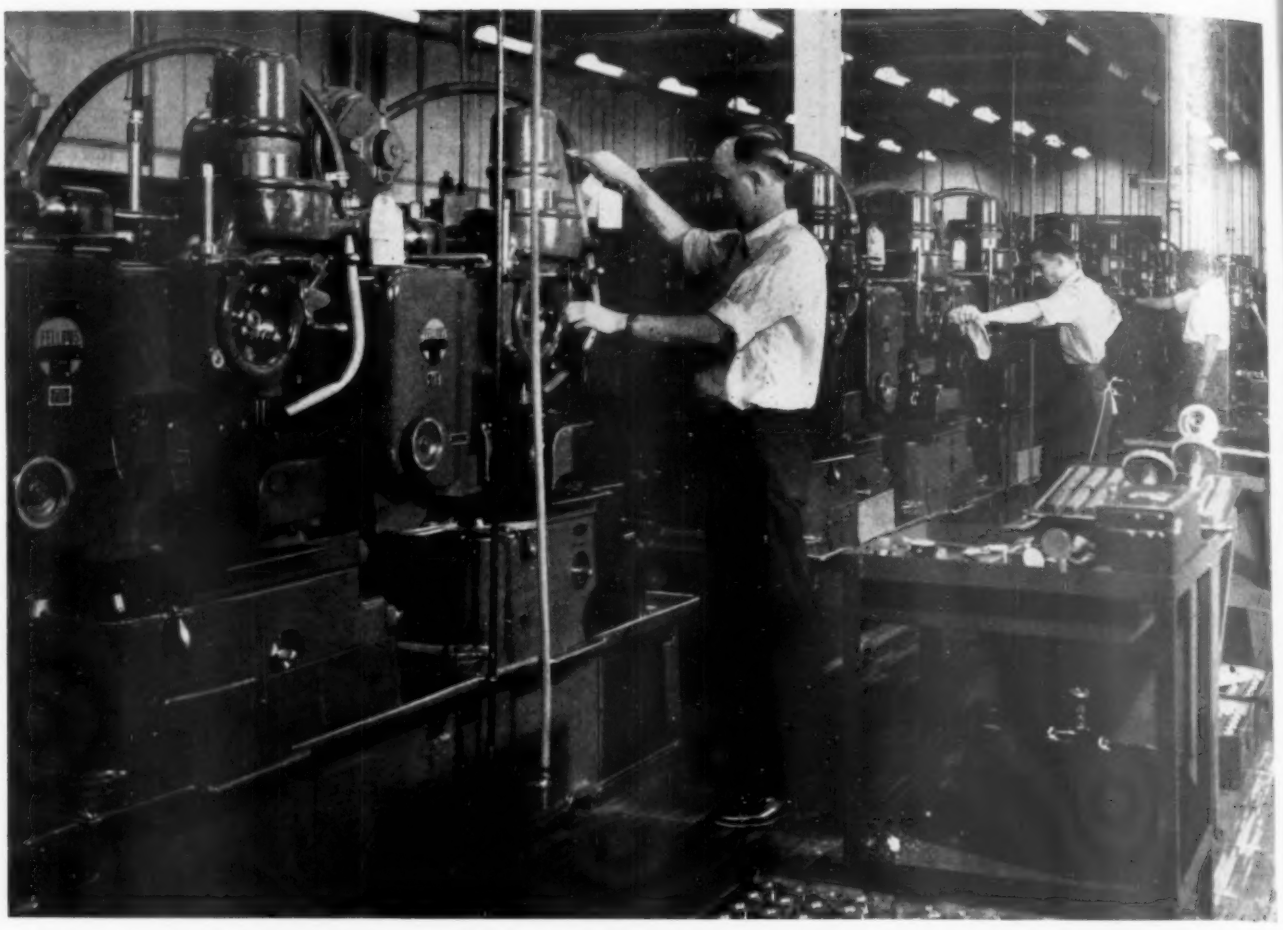
An example of this is shown in the generation of the jaws on the starter engagement coupling. The three jaws are cut on a Fellows shaper, a production improvement over previous methods of cutting and grinding.

Another change from conventional practice was developed for cutting an internal gear. Previous practice had been to take three cuts on a Fellows shaper — two rough and one finish — on the same machine, with the same cutter. Studebaker engineers take a rough cut on one machine and finish with two cuts on another shaper, using a sharper tool. Better finish and less burden on lapping are the results of this method.

FREE BROACHING BORE

On internal bores, on the trunnions of the reduction gear carrier, finish honing tended to bell-mouth the bore. Small broaches, pushed through the bore by an arbor press, corrected the difficulty and produced a finished surface. On the other hand, the shaft bearing on the cam, with a bore depth considerably less than diameter, is successfully honed on Micromatic equipment.

Aircraft gears call for light, tough metals. In regular use are AMS 6250 carburized, and 6470 Nitralloy. AMS 6290 and 6254 carburized are also well-suited to gear fabrication.



Rough and finish cutting gear teeth on supercharger intermediate gear shaft on Fellows gear shapers.

Common practice with most forgings, before delivery to active stock, is to anneal or normalize, depending upon the parts and operations. Upon removal from the furnaces, forgings are given 100 per cent Brinell tests. Pangborn sandblast equipment is used to make surfaces machinable. After normalizing and annealing, stock is temporarily stored.

An outline of the operational sequence developed for the 135-tooth internal reduction gear which fits over the trunnion carrier in the planetary system illustrates the amount of machining required in aircraft gear production. The normalized forging is rough and finish turned in successive operations on Gisholt lathes, with internal finishing on a Heald Red-Head grinder, removing .018 to .020-inch. Norton grinders finish external surfaces and polishing removes tool marks.

CARE WITH NITRIDED SURFACES

Finish machined surfaces are then nitrided. Tin plate protects surfaces on which teeth are to be cut or further machined. In finish grinding and polishing nitrided surfaces — necessary to correct any slight distortion, no more than .003-inch can be removed safely. Below that depth, the case will not meet Rockwell specifications.

At Studebaker, this internal gear is rough cut on one machine, and finished in two cuts on a second machine, utilizing sharper tools than are required for roughing. The 135-teeth, on the internal gear are maintained in strict relation to the pitch diameter on the smaller external spur gear. Tolerance is within .002-inch. Back lash is checked against a master.

Following nitriding in E & F electric furnaces at 975 F-.018 to .20 case, .060-inch is removed by internal grinding, before cutting the spline. Though this surface is protected by tin, this is considered practical from the point of view that protection to spline cutters is needed against possible nitride seepage.

The spline must be located in relation to the external spur. On the fixture, by locating a master over the external teeth, the spline cutter is accurately positioned. The internal spline is ground to .001-inch limit on a Detroit Gear Grinder. Dressing between cuts of the formed wheel is automatic. A Pratt & Whitney shaper removes one tooth of the spline to permit setting the gear on the shaft in proper position for timing.

Final operations on the internal or bull gear, include scribing for timing on an engraving machine, visual inspection and 100 per cent Magnaflux inspection.

Another sequence, highly involved from a machining angle, has been developed for the trunnion carrier which fits within the bull gear. Pinions fitting over the 20 trunnions on the perimeter of the carrier transmit power from the bull gear to the propeller shaft.

INTERRUPTED CUT WITH CARBIDES

Stock for the carrier comes as a forging complete with trunnions or bosses, which is turned down in preliminary machining. Cemented carbide tools are in almost 100 per cent use for turning and boring operations. On a Gisholt lathe, the carrier is chucked between face and sides of the bosses, for a skin cut on the O.D.

After boring the web face, cuts on the trunnion faces and counterbore of the web are made simultaneously. Though the face cut on trunnions is interrupted, and thus not ordinarily made with cemented carbides, the continuous cut on the simultaneous counterboring operation steadies the tool post, maintaining tension so as to bridge the shock on the other tool.

SEQUENCE ON TRUNNION CARRIER

Back face and trunnion face are ground externally on a Blanchard, internally on a Bryant. A Baker hollow mill rough turns the trunnions. On a second machine, the surface between the trunnions is rough cut, leaving a pad around the base of the trunnions. The entire piece is copper plated, and then a bevel cut is made on the O.D. on a Gisholt. The I.D. is undercut beneath the trunnions, oil grooves on the trunnions are milled on LeMaires, and oil holes drilled in the trunnions on Leland and Gifford machines. A Borematic is used to remove a copper plate on the trunnions. Oil holes are local cased, the piece is passed through a degreaser and exposed sections are carburized. Local case is removed, the copper stripped and the piece is ready for grinding.

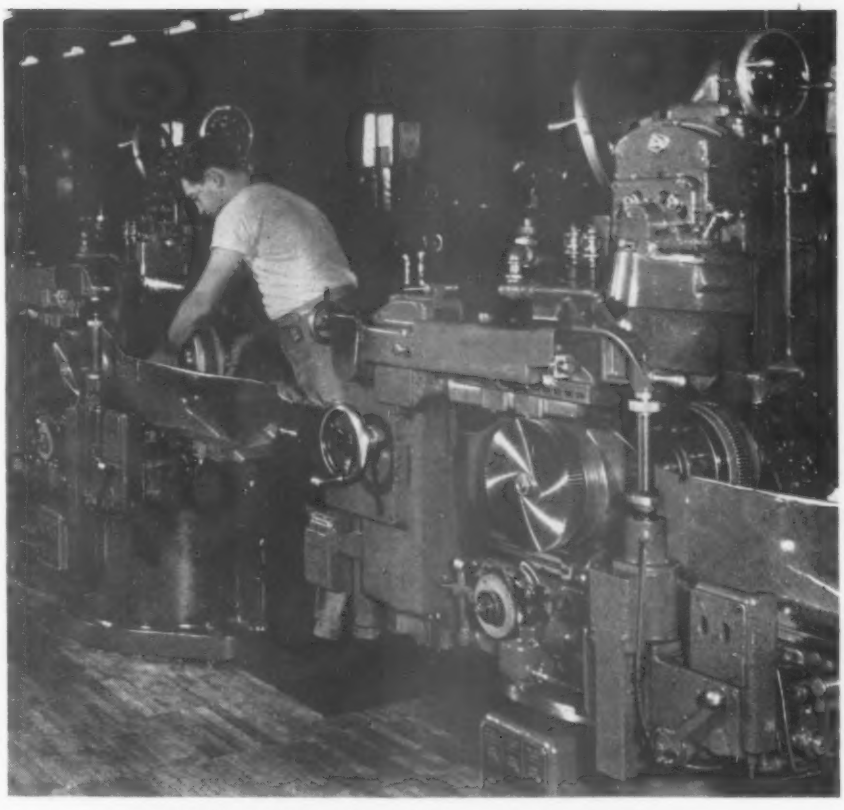
On a Blanchard the end of the trunnions are ground, back face and inside web face are ground. Holes are internally ground and counterbored. Multi-spindle Natcos drill trunnions and ream. A second machine chamfers and finish drills oil holes. The web face is polished.

An American Broach machine used as an arbor press pushes free broaches through the trunnion holes, removing approximately .008-inch.

MANDREL HOLDS DIMENSIONS

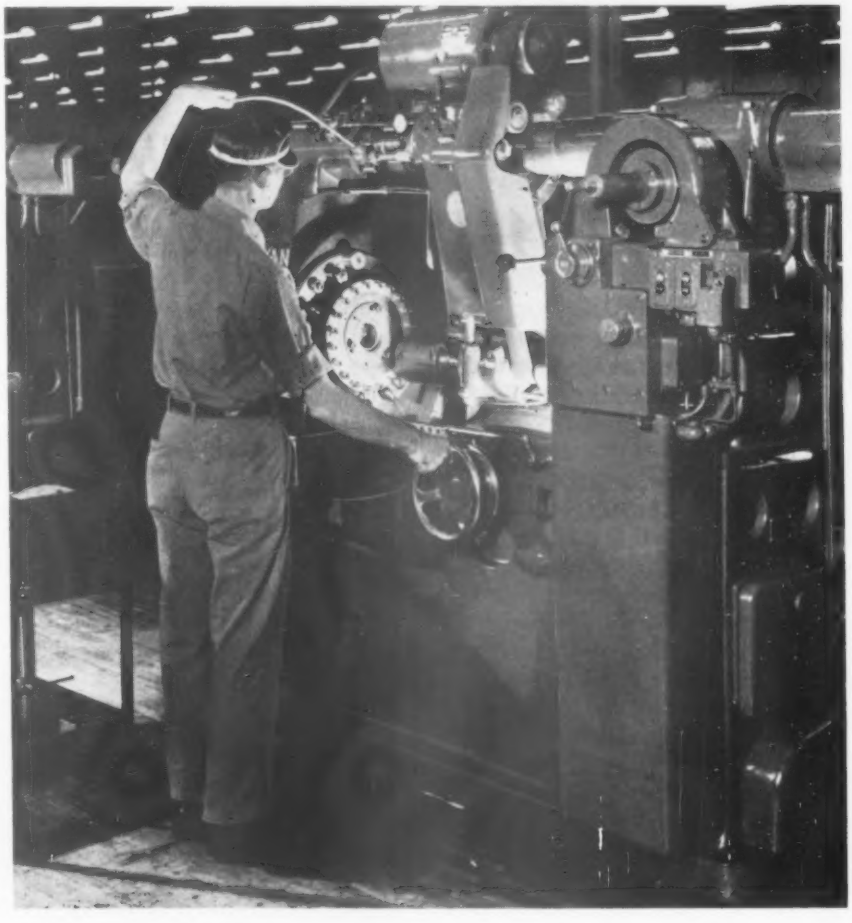
Before finish grinding the outer and internal diameters, of the carrier, following hardening, a mandrel is inserted in the center of the work to hold dimensions against any tendency to distortion because of the heat differential in grinding the various sections of the part. This assures accurate inspection of machining results at the site of the operation.

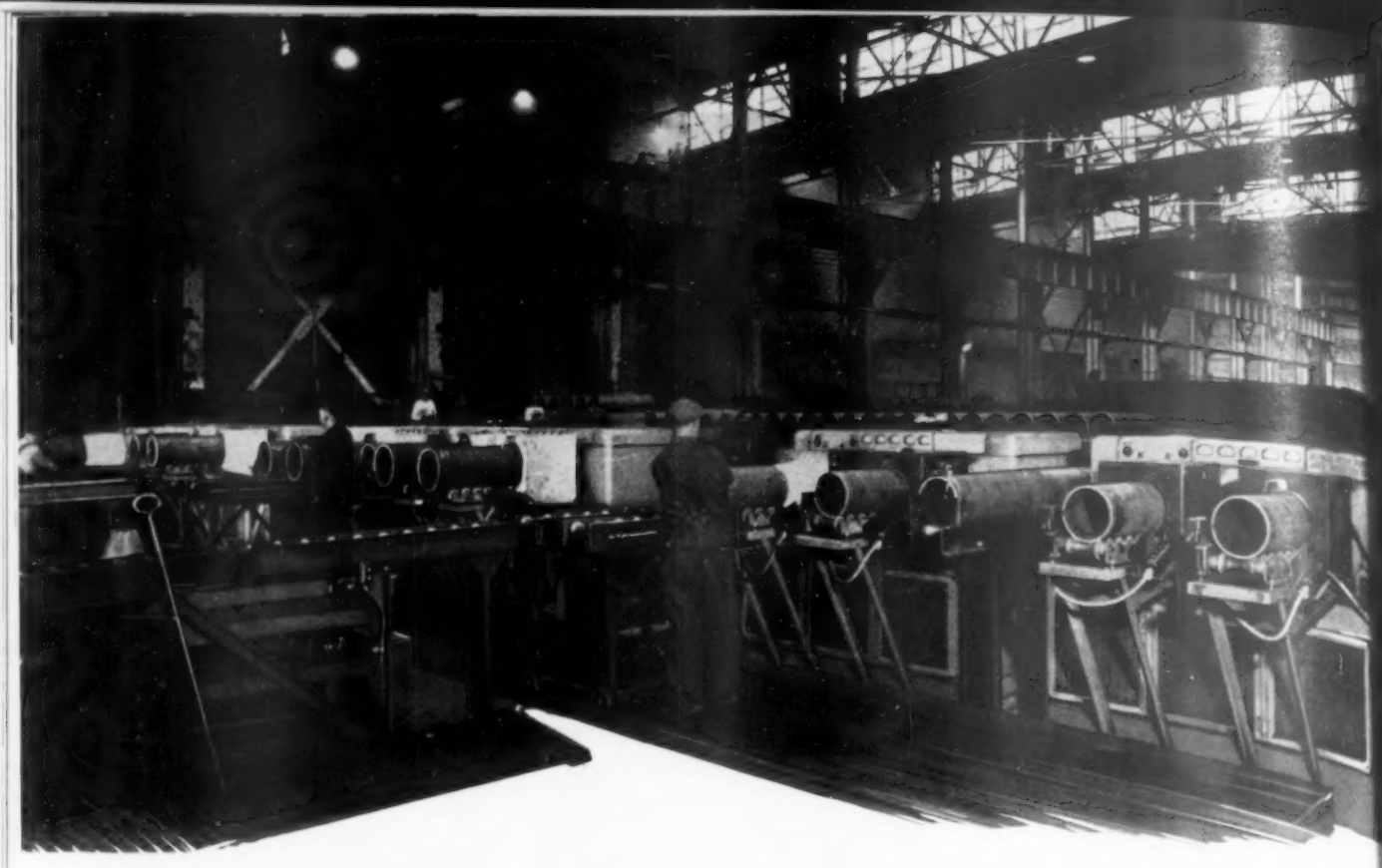
For final grinding of the trunnions, over which the 20 pinions fit, a Bryant machine is used with a hollow wheel. The part is indexed on the head of the machine. In final finishing, edges are broken to a radius, the flats are polished and the entire part 100 per cent Magnaflux inspected. THE END.



Grinding 105 teeth on stationary reduction gear.

Grinding outer diameter of trunnions on gear reduction pinion carrier.





Battery of Tocco induction machines used in heating for nosing 250- and 500-pound bomb casings. Note two hot casings being removed from inductors. These are two-station units.

One operator can easily handle two machines. In immediate foreground are units for 250-pound bomb casings. Others are for 500-pound casings. Conveyors at left lead to spinning machines.

Induction Heating and Automatic Spinner Cut Steps in SHAPING BOMB CASINGS

A COMBINATION of an automatically controlled spinner and induction heating is now enabling the Wheeling Steel Corporation to shape large one-piece 250-pound and 500-pound high explosive bomb casings in just two operations. This is in contrast to certain other methods which require upwards to 10 steps with reheats before the final shape is achieved. Further, the induction process is a new method of heating for hot working of steel by steel mills.

In a battery of 200 K.W. 3000-cycle Tocco Jr. induction machines equipped with inductors designed for this work by Ohio Crankshaft Company, the casings that have been cut from heavy steel pipe are heated first for the shaping of the nose and then for the tail. Spinning follows each heating. Elapsed time for these two operations on the 500-pound bomb does not exceed fourteen minutes, while the smaller bomb is finished considerably faster.

Developed by Wheeling Steel, the automatic control of the spinner has proved successful in speeding the shaping process. Induction heat is a large factor in achieving this result, report Wheeling officials. Because the induction heating machines could be placed close to the spinners it was possible to establish a regular production-line procedure. Casings are manually withdrawn from the large multiturn inductor coils onto a roller conveyor which slides the heated pipe to the spinner.

After nosing, the casing is lifted to a gravity conveyor down which it passes to the next heating unit for tailing operations. En route the pipe goes through a cooling compartment. Then the tail is heated and spun into a truncated cone with open end — and a new bomb case is ready for the next operation.

"We have found that use of the induction process has speeded operations far above expectations. Results are exceeding those which other methods originally considered would have given us. There is no waste of fuel or heat. This makes working conditions cleaner and many times cooler. Over and above that, we get greater uniformity of heat in the casings," says Andrew Toth, bomb plant supervisor.

Each of the induction units is a two-station machine able to use 100 per cent of its capacity. Each operates on a 440-volt hookup. A push-button control panel is located con-

veniently at hip level beside the fixtures for each station. High heat is confined to the specified area on the pipe. Thus, casings can be handled by operators from inductor to spinner without tongs. Inductor coils are water cooled, having a diameter sufficient to give ½-inch clearance between metal and coil.

In the heating of the smaller bomb casing a temperature of 2000° F. is reached. Heating cycle for the tail of the casing is only 90 seconds while that for the nose is two minutes and fifteen seconds. This difference results from the fact that the nose end is heated over a greater area of the pipe than that for the tail.

STEPS UP PRODUCTION

Temperatures for the 500-pounder reach 2200° F. As in the other piece the heating cycles for the rear and nose differ by about a minute. Three minutes and fifteen seconds are required to heat the tail while the nose comes rapidly to temperature in just four minutes and twenty seconds.

In both casings steel is plain carbon. The O.D. of the pieces is approximately 11 inches for the 250-pound casing and 15 inches for the other.

Currently, the stepped-up aerial activity of the Allied Nations puts bomb production at, or near, the top of the urgent list in war production. Many new industrial applications such as induction heating are enabling production schedules to be expanded.

The Tocco Process that grew out of a need for improving the technique of hardening automotive crankshaft bearings is today performing many vital war production jobs in numerous fields. It is brazing, surface hardening and heating for forming.

ACCURATE CONTROL

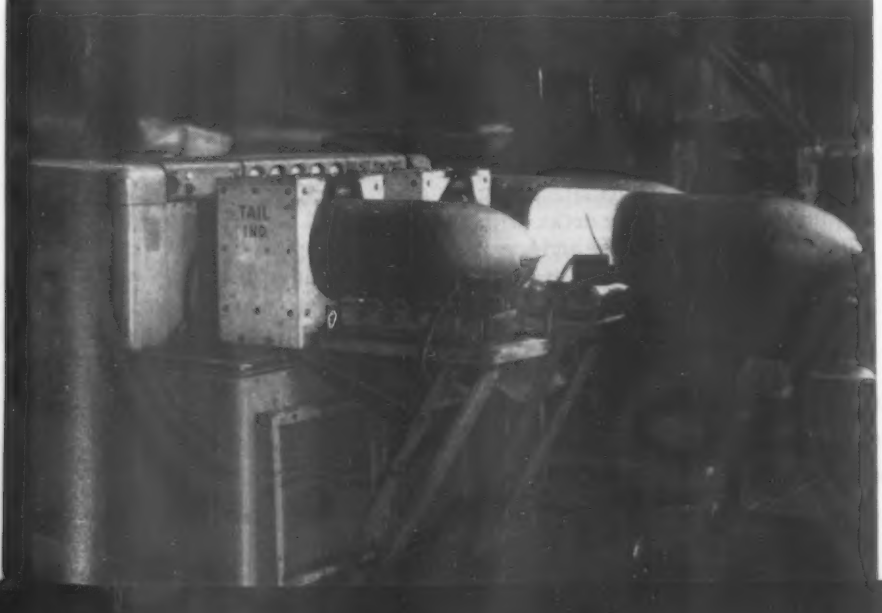
High-frequency electrical current is fed into a water-cooled inductor designed to fit a given part. When the metal is exposed to the field of the inductor, current flows into the metal setting up molecular friction in the outer surface areas. This friction results in high heat in the piece.

It is possible to control closely the depth of heat and the extent of the heated area. Hardness can also be controlled with great accuracy.

The U. S. Ordnance office has publicly recognized the part induction heat-treatment has played in furthering output of war materiel and the conservation of vital metals. The hardening of armor piercing shot by induction heating is said to be one of the three leading industrial contributions of the war. THE END.

Bomb casings being Tocco-heated prior to tail spinning. Operator has just removed a 500-pounder's casing from the inductor. Note absence of tongs, although heat-treated end is up to 2000°. This is the first phase of the second operation in the shaping of bomb cases at Wheeling Steel. Last phase is shaping tail area into a truncated cone.

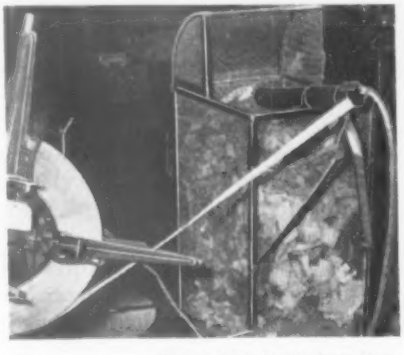
On this induction machine only three minutes and fifteen seconds are required to heat the tail end of the pipe. A second bomb is heating while a third case is ready at the end of a gravity conveyor (in the background). An old gas furnace stands unused in the rear of the picture. Tocco units are products of The Ohio Crankshaft Company.



Compressed Air Strips Paper From Rolled Stainless Steel

IN the manufacture of self-locking nuts, conduit clamps and similar products from metal strip, a means had to be found to separate the long strips of paper which are rolled up with the strips of stainless steel.

Engineers found that when the metal was fed into the presses, there was no convenient way of discarding the paper. So, with a few lengths of pipe, they devised a compressed air blow gun. As the metal feeds into the die stamping machine, the end of the paper is fed into the "barrel" of the gun.



Compressed Air Institute Photo

The barrel is 3-inch pipe, about 2 feet long. Into one end is inserted the open end of a pipe, about one inch in diameter, carrying a current of compressed air.

The air is blown into the barrel in the same direction that the paper travels, so, as the metal is fed off the roll, the air pressure keeps the paper traveling through the barrel, and on into a waste basket.

In another problem, this company used compressed air to separate nuts after lacquering. Lacquer is sprayed on the small parts in a revolving hopper. In the course of drying, many of the light pieces of metal adhere to each other.

Separation by hand consumed man hours. Another gun was devised, with the outlet of the compressed air pipe a few inches below the mouth of the barrel. Nuts are permitted to drop from a tray, a few at a time, into the air stream. They are immediately blown through the gun under approximately 90 pounds pressure, and shot against a heavy wire screen at the other end of the apparatus.

THE END.

PLANT LAYOUT

A. E. RYLANDER
TECHNICAL EDITOR

THE sharp trend toward economy in manufacture is shaped by various conditions, as primarily, the utter necessity of balancing unit costs against high wages. Lessons learned now will be useful in meeting post-war competition. However, the direct and immediate bearing on industrial man power may be instrumental in shortening the war, certainly in reducing its cost.

Further, there is a tendency to economize because original procedures, set up in the rush of conversion have often proven too costly. In part, attention is given this phase because of a feeling that the war may be considerably protracted.

Still more modification in tooling, methods and handling—in short in plant layout, has been necessitated by the influx of women into industry.

This series of articles is in direct response to a demand for up-to-date information on plant layout. Logically, the author begins with a paper on plant design, because the fundamental of plant layout is the plant itself. Cost-saving ideas will follow, in detail, in later installments.

TO ATTEMPT plant layout without a fundamental knowledge of plant construction and engineering would be tantamount to putting the cart before the horse. So, we'll start with plant design, which, at the best, is a compromise between an ideal and the limitations of time and space. For, even though one starts from scratch, with an ideal in mind and an expanse of land in which to play, probable expansion and inevitable changes in product will eventually obsolete the concept. There is no such thing as permanence in a progressive organization since, without change, there can be no progress. One can, however, design a plant suited to a specific product and, anticipating demand and future trend, plan for expansion.

Some years ago, the writer drew up the preliminary plans for a plant that not only took care of immediate requirements but provided for both horizontal and vertical expansion to meet future demand. In this case the product happened to be machine tools, special machinery and appliances — the latter on mass production — which made the problem comparatively simple. Nevertheless, the layout had various futuristic features (it anticipated a trend) and, since these may be applied to present day needs, its essentials are shown in Figures 1 and 1-a.

FLOOR PLAN OF BUILDING

Described in present tense, the office building fronts the street, with lobby and general offices on the first floor, accounting and engineering over. (Footings and columns were proportioned for addition of a third floor). A service hall, with stairwell to basement and second floor, serves for inter-office communication and gives access to the shops. Receiving is under the offices and served by a one-way ramped drive. Here, also, is storage for bar stock and small goods, heavy castings and such being received at shipping, which is at the extreme rear. Heavy material being occasional, it was concluded that the compromise would result in fairly progressive handling. It did.

The main building is monitor roofed and crane serviced, with ells extending to within a foot or so of the office building sidelines. This scheme permits of ample natural light (not so futuristic, eh?) while providing for lateral expansions by the simple expedient of roofing over the areas and joining the side walls. The ells are two storied, open to the main building, with projecting balconies for crane service. Light manufacturing and tool room is on upper decks, with milling and turning — lathe and screw machines — below. Heavy machine work, such as planing, boring, is handled on the main floor, which also serves for assembling and erecting.

The plan shown gives a general idea without going into detail. And, viewed through modern eyes, one might be inclined to question the efficiency of the design. Why the ells? — why not have walled in the areas at the start? Briefly put, the aim was to isolate the offices, previously incorporated in the main building; also, artificial lighting left much to be desired at the time the plant was designed. Hence the areas. Note, too, the different levels of office and shops, with receiving and stores on a half level. This permitted easy passing of material — especially bar stock — to the shops. Finally, there was just so much land and thought had been given to employees' parking despite the fact that street cars and shanks mare were still popular means of transportation. Beyond that explanation, no apologies. Although the original plans were somewhat modified, the plant is still going and by no means out dated.

One cannot, of course, present a plant design that would be suited to

If war ends tomorrow, plant layout will be of first importance. If it is prolonged, you will want to know ways of cutting costs. Begin this series with this important foundation article on plant design.

First series on this vital subject in two years! Though details of actual plant layouts are strictly censored, THE TOOL ENGINEER offers methods and facts which will improve production.

general requirements. There are no general requirements in manufacturing. For such duplication we would go to the chain stores or, in a more restricted sense, to the service stations of our larger automobile manufacturers. Even then, there is only superficial sameness. Or, one can have erected plant buildings from standardized plans and structural units, but here, again, standardization might not meet the demands of a specific product.

What are you going to make? — and how are you going to make it? Layout for a rolling mill and a cable plant would be as the locomotive and the tug boat, despite that both are used for towing. If one can start from scratch — a rare privilege — with time in which to plan, then design the plant to suit the product. We'll try it, eh? — if only to initiate ourselves into the intricacies of plant design and construction.

We'll but superficially mention the office building. It's important, of course, especially in this day when multiple forms entail ten clerks where one sufficed before. And, it's the "front", bespeaking the character and dignity of the Company. But, its disposition is up to Prexy, that august personage having long cherished his particular ideal and none to say him nay. We'll go on to engineering.

Until quite recently, comparatively few concerns gave more than passing thought to the engineering offices, an omission largely corrected now that engineers are getting due recognition. (They used to be called "expense men"; now, they're *cost cutters*). Yet, more than thirty years ago, Taft-Peirce Manufacturing Company had a close approach to ideal engineering conditions. And, about the same time, International Typesetting laid out a modernistic engineering office, while the late A. J. Langelier's first thought, twenty-five years ago, was to engineering.

FIGURE 1-a.

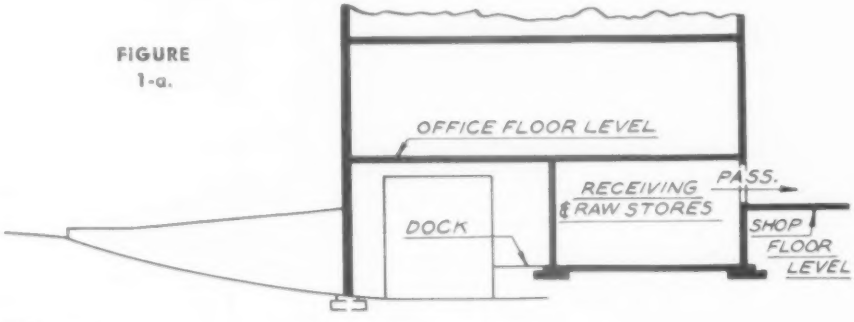
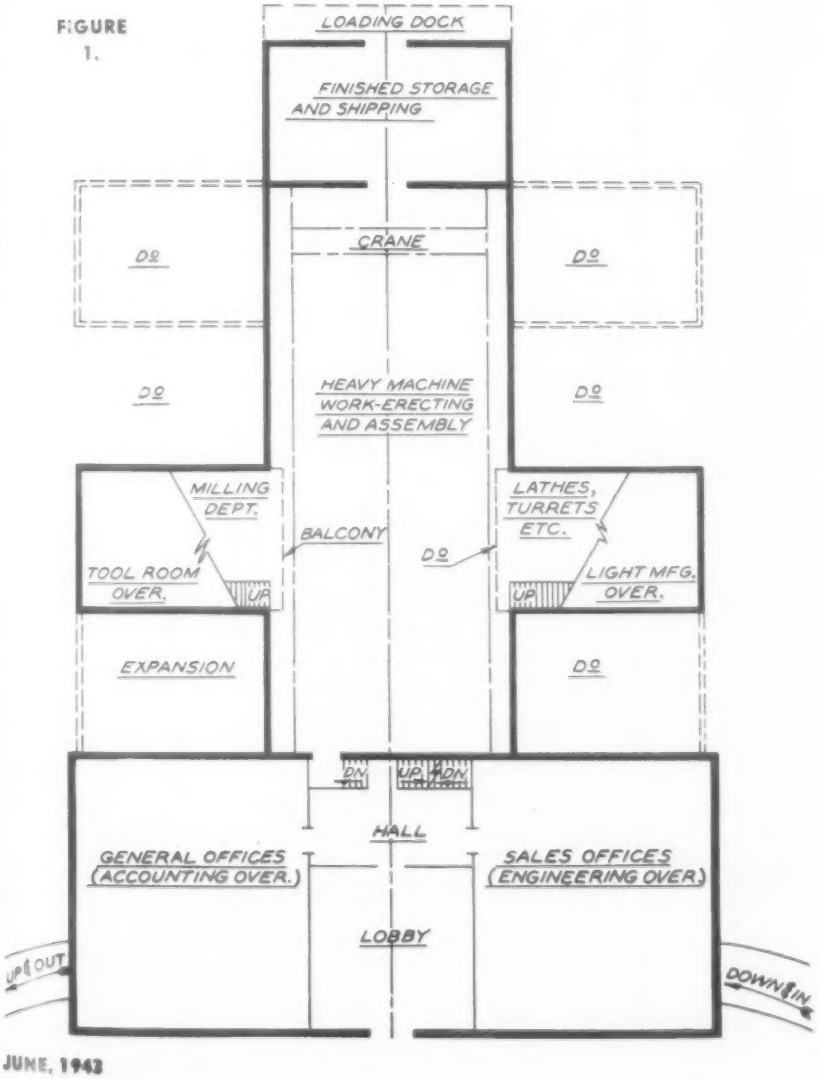


FIGURE 1.



Today, we have sound proofing, air conditioning, windowless buildings, indirect lighting and all the appurtenances of the modern age along with "mechanical brains" with which to check the checkers. And why not? After all, engineering is the Alpha and Omega of modern mass production. While engineers may not necessarily conceive the product (although invention implies the engineering mind) they usually refine the product, process and tool it and plan every step from concept to execution, from receiving to shipping — yes, and to final installation.

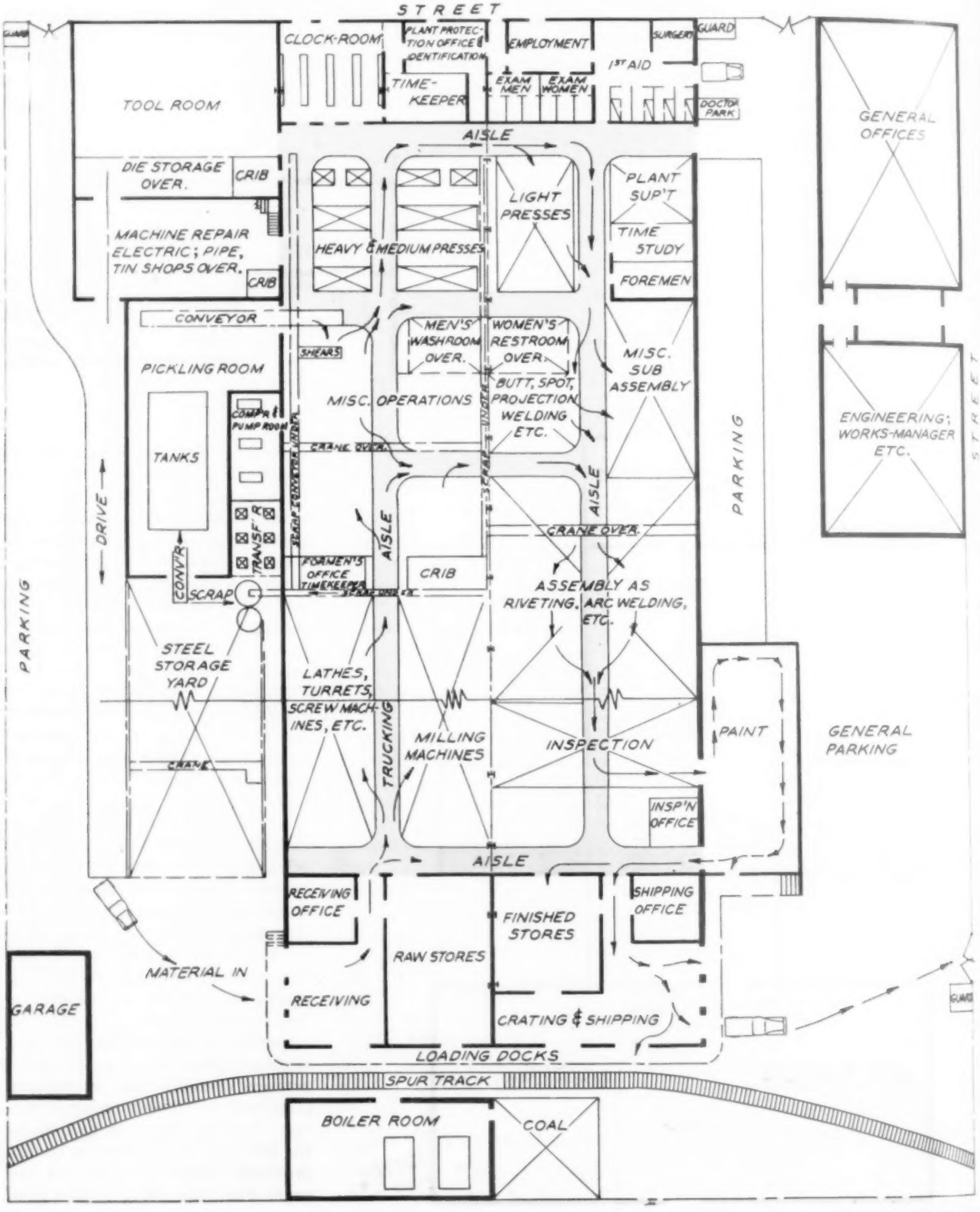
Starting on that premise, then, we'll engineer a plant. Assuming, as a product, an assembly that incorporates press work and the machining of castings, forgings, bar stock and so on, the first step is to determine the approximate output for the first few years. That done, we'll set up a plant

to that scale. There will be so many castings to machine, so much bar stock to process, so many stampings to make, so much fabrication of subassemblies and so much of final assembly along with inspection, painting and shipping. Each workpiece must be routed through its various operations, so, we determine the general line of machine tools and miscellanea which will be employed.

For purpose of layout, it doesn't matter which item we take first — they'll all have to go in. Well then, we'll make paper cut-outs of our machines, and start arranging them on the board. So many turret lathes, so many screw machines, so many lathes

FIGURE 2.

The author's preliminary layout which, as he mentions, "is by no means an 'ideal plan' . . . and is to be considered purely illustrative."



millers, drills and so on. At first thought we'd like to segregate them into departments, but modern processing frowns on such arbitrary isolation (we'll go into that later) so, we lay out according to operations and the most efficient handling. Then, having arranged our equipment in tentative sequence, we make a temporary record, noting that we need so many square feet of space for machine tools.

OPERATIONS SPACE

Next, the press room. So many large blanking presses, so many forming presses and miscellanea, including shears. The steel will likely have to be pickled, so we provide for pickling, and, since we are going modern, we'll anticipate "controlled" output by the ... er, human element . . . and make it automatic. More space! — more length and height. We don't want manual handling, so we provide conveyor systems, both to serve the presses and to dispose of scrap. The press room, then, requires so much space; we'll add that to the metal cutting department.

Next, we have assembly, so we plot the probable course of product through sub and final assemblies, the whole involving welding, riveting, repairs and inspection. Then to painting, finished stores and, finally, shipping. F.O.B.! By now, we have the approximate floor area required for manufacturing; we also know how much land we have available for plant, yards, etc. Of course, we're scattered all over the clock, but we'll straighten out the mess later. Right now, we'll draw up a rectangular building, if only as something to criticize. It will all be changed as we go along.

MANUFACTURING SPACE PLUS

Manufacturing space alone does not suffice. To manufacture, one must have tools, so, we lay out a tool room, and, since equipment will wear and tear, we also provide for maintenance. This will include machine shop, pipe and electric shops and possibly a tin shop. Time was when you'd include 'em all in one, but "them were the days" when machinists were jacks-of-all-trades. But today, the machine repair man waits *patiently* for a piper to unscrew a union while the latter in turn as patiently waits for an electrician to pull a switch. Too much specialization! Anyway, add tool room and maintenance to the space which has already been plotted.

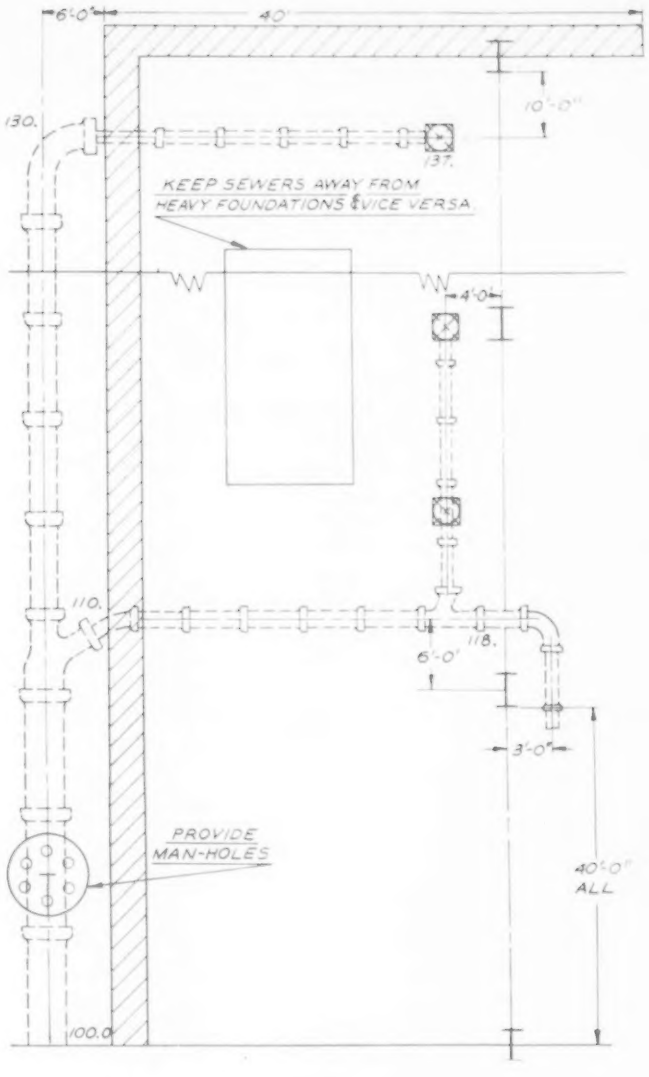


FIGURE 3.

Sewer lines.

Next, we provide storage space, inside as well as in the yards, and foremen's offices, tool and materials cribs. We also provide parking space (streets should be for traffic) and strategically disposed coops — "guard houses" — for plant protection personnel, as well as a central "police" station, the latter provided — for the duration at least — with facilities for finger printing and photography. We also provide an employment office somewhat remote from the general offices and adjacent to the clock rooms of which there may be one or several, together with a central timekeeper's office. In large plants, there should be departmental time offices. Then, we must have a first aid, now set up into male and female "wards", and comfort facilities — toilets, washrooms and locker rooms — together with rooms where men and women may decently eat their lunches. The latter might well have a canteen bar serving coffee, tea, milk and pop.

We have to have heat, so there must be a boiler or furnace room, and, if we want maximum efficiency, we should have air conditioning. No more complaints about "intolerable conditions"! And, since we'll use both pneumatic and hydraulic equipment, we'll require compressors and pumps. Naturally, we'll use electricity, so we'll have transformer houses and bus lines to consider. Begins to look as if the plant engineer must be a rather versatile jack-of-all-trades eh?

By now, we're getting our plant pretty well organized, with building areas known and subject only to final revision. At this stage, we'll consider handling, so we'll plot in conveyor systems and craneways — the latter naturally spanning the buildings. Coincidentally, we lay out sewer lines — and here, a word of caution to the uninitiated. Keep sewers away from

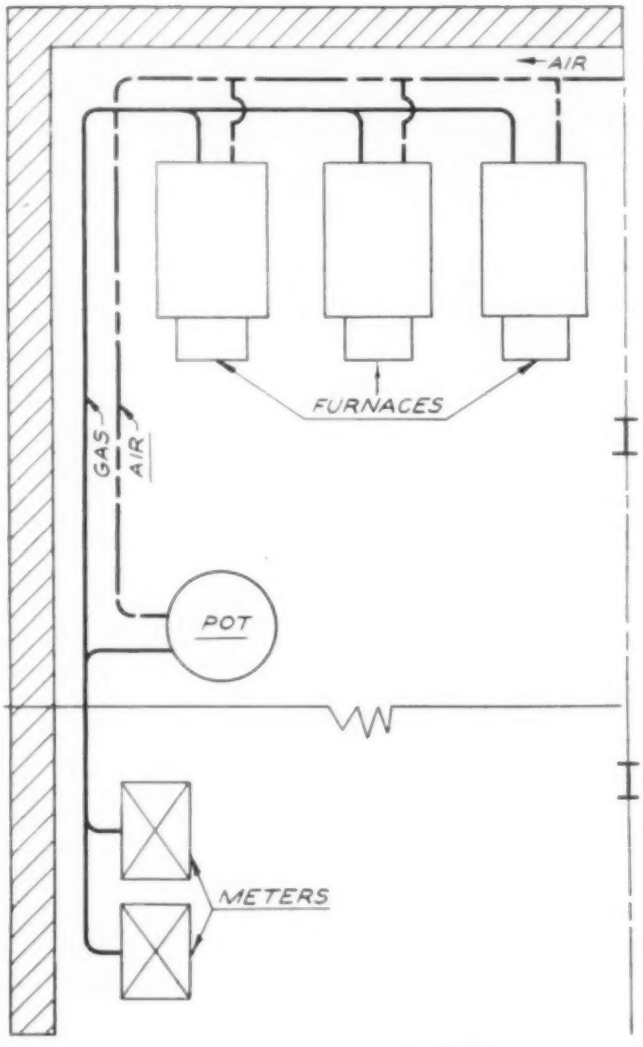


FIGURE 4.

Gas and air lines.

heavy machine foundations and especially from press pits; vice versa if sewers are already in, as in the case of old plants. Sewer crock is allergic to shock and vibration. Note down, particularly, locations of main and laterals, and levels, so that in event of trouble we know exactly where to break in. Make separate details of all lines; sewer, water, steam, gas, air, oil and electric conduits. Provision must be made for sprinklers.

All that done, and hoping nothing is forgotten, we'll call in the architect. While waiting for his preliminary plan, we'll refine our layout, ordering equipment as each detail of plan is definitely settled. (Of course, we've already anticipated remote deliveries). The idea is that machinery should be installed as the building progresses, and, to be up and coming, product should begin fl[illegible]ng into shipping while the concre[illegible] is hardening on the loading dock.

Now, all the items men[illegible]ood take space to describe, and th[illegible]ost deserve separate treatment[illegible]e whole to long for consideration in [illegible]e space remaining. We will therefor[illegible]nclude this installment by presenti[illegible]our preliminary layout, shown in [illegible]igure 2. And here, frank confession. It is by no means an "ideal plan" — although it has its points—sinc[illegible] it was drawn to fit the space of a printed page and is to be considered purely illustrative. Yet, it contains practically all of the elements mentioned except details, and we'll take those up in a sequel. Note the details — Figures 3, 4 and 5 — showing charting of pipe lines. In practise, these should be colored, each color symbolic of its service, with copies disposed in the offices of the plant engineer and master mechanic as well as in the maintenance shops. Here, we merely illustrate.

Also note, particularly, the flow of material — the reason for plant layout. Note that the spur track serves three departments; the boiler room (with coal), receiving and shipping; also, note that the latter two are adjacent, without the one interfering with the other. As the plant grows, we may want to combine both into one. Well, as aforesaid, the plan will not suit your particular requirements, but it does include, tentatively, most of the items you would have to think of if you were laying out your particular ideal of a manufacturing plant. In later installments (who knows?) we may hit right down your alley; at least, we'll give you ideas that you can apply to your specific problems.

This concludes the first of a series of articles on plant layout by Mr. Rylander.

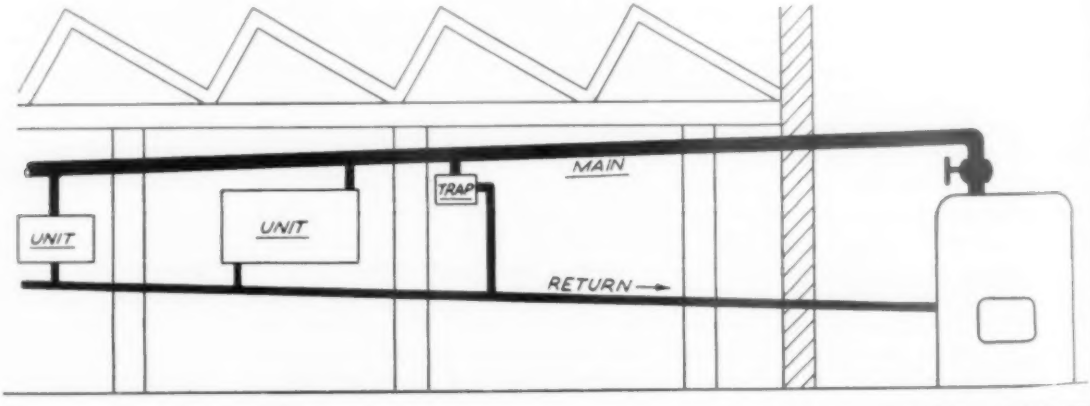


FIGURE 5.

Schematic layout of steam lines.

NITRIDING High-Speed Tools

G. WALTER ESAU
E. F. HOUGHTON & COMPANY

FINAL casing of high speed steel tools known as "nitriding" is entirely different from the process where gaseous ammonia is employed to form an iron "nitride" surface on steel parts.

"Nitriding" high speed steel tools is simpler and is applied through the medium of a molten salt bath at recommended temperatures for tempering particular types of high speed steel. Within the last four years, several leading manufacturers have developed salt bath materials to produce uniform and controllable results.

Carbides Produce Soft Skin

Their research indicated the reason for certain erratic results formerly obtained with straight sodium and potassium cyanide mixtures, where there was not only a formation of nitrides in the surface of the steel but also some formation of carbides. This ratio between the carbide and the nitride formations and penetrations varied according to the actual cyanide content in the bath. With high cyanide content, as when the bath was first started, there would be practically all nitride in the case formation. If, however, the cyanide content was lowered during operation of the bath, the ratio of carbide would be increased with a consequent decrease in nitride. Research on the absorption of carbon or carbides on the surface of high speed steel tools, has indicated that any appreciable absorption of carbide will produce a soft skin. Many users of high speed steel tools had believed soft skin was produced by decarburization, whereas the surface of the high speed steel was actually carburized.

The ideal condition for high speed steel, after hardening, is the austenitic state in which most of the tungsten and chrome carbides are absorbed into solid solution. This austenitic state is then drawn so that it approaches the martensitic to produce greater hardness in the drawing operation at 1050 to 1150° F. Any addition of carbon will partially prevent this and will produce a soft skin.

Where 18-4-1 steel in many controlled atmospheres at the hardening temperature will carburize rapidly, high speed "moly" steel tends to decarburize. High temperature salt bath treatment eliminates this problem. Present salt bath materials are easily controlled so that any type of high speed steel, including "moly" types, can be treated.

The high speed steel manufacturer has gone to great pains to determine the ideal analysis and eutectics of the alloys in his steels. Additions or subtractions from these elements are not usually beneficial. Heat treatment should not alter the outside analysis unless it is an approved process which will not penetrate to any great depth and alter the ductility of the entire tool. Carburization of the 18-4-1 tungsten type and decarburization of the "moly" type produce soft skins to a depth which cannot be corrected. Although of the two, slight decarburization is preferable because the addition of nitrides will tend to neutralize the soft skin which it produces.

Because final casing or nitriding is applied after complete heat treatment and finish grind, full advantage will be secured only when used on tools which have been subjected to a correct heat treatment.

Secret of Uniformity

A typical nitriding bath has a melting point of approximately 900° F., with an operating range of 950° to 1200° F. It is a cyanide base bath, to which other materials have been added to control the rate of decomposition of the cyanide, and to further control the rate of absorption of nitrides into the surface of the high speed steel tools being treated and to inhibit the absorption of carbon or carbides.

Because of the balanced nature of these nitriding baths, uniform results are obtained at all times. With most installations only sufficient fresh bath material is added to make up for drag-out losses. However, where little work passes through, and drag-out losses are insufficient to maintain a balanced bath, it is necessary to bail out 5 to 10 per cent of the weight of the material in the pot each week and replace with fresh salt.

Conventional salt bath equipment is used for these baths and pressed steel pots are exceptionally long lived at these low temperatures. This equipment may be heated electrically or by gas. Bath temperature, however, must be closely controlled, since treatment is carried on after the final temper and finish grind.

The usual temperature of the ni-

Results from Nitriding

- An automotive plant operating Cone Automatics on the production of 37-mm. shells found that a two-hour nitriding treatment of high speed steel tools increased life at least 200 per cent. Box tool life was increased from eight hours between grinds to two days.

- A plant tapping 20-mm. shells on hand-screw machines reported an increase of from 500 to 1600 pieces per tap regrind.

- Another plant producing 20-mm. shells was tapping less than 100 shells before regrinding. The taps—both 18-4-1 and "moly" steel—were given a one-hour nitriding treatment at 1050° F. and then cooled slowly in sand. Tap life has been doubled.

- A Canadian munitions plant found that a 300 per cent increase in life of reamers, bits, and rifling cutters was obtained by nitriding.

With many problems of war production rapidly approaching solution, methods of increasing tool life continue to attract wide attention. Here are claims for nitriding by the molten salt bath application.

triding treatment is either at or slightly below, the final tempering temperature, generally in the range of 1025° - 1050° F. When extremely fragile tools are treated, a lower temperature in the range of 950° - 1000° F. is preferable. The time of treatment will vary from 10 minutes to 1½ hours.

Tools subject to considerable chatter or shock, especially those used on ferrous metals, should, for the best results, be treated for shorter periods, whereas for tools used on non-ferrous metals, hard rubber or plastics, longer periods are advantageous. In most instances, especially on milling and gear cutters, an extremely heavy case should be avoided, for although the number of pieces between grinds might be increased, the total number of grinds per tool might be decreased, due to deeper chipping when the tool does fail.

Depth of Hard Case

The usual depth of penetration of the nitride layer is from .001" to .002" for treatments of 30 minutes to 1½ hours, and below .001" for treatments of 10 to 20 minutes. This superficial case is extremely hard and cannot be measured by ordinary hardness testing methods, and must be obtained by methods employing the scratch test or Vickers Hardness readings. Hardness readings obtained with 30, 60 and 90 minute treatments of high speed steel tools as shown below were determined with the Vickers test and have been transformed to Brinell.

1050° F.	Penetration	Average Case—Brinell
30 min.	.0013	937
60 min.	.0017	1026
90 min.	.0019	1065

These Brinells may be slightly low as even the Vickers may be recording some of the hardness of the true high speed steel backing and not the true abrasive hardness of the nitride case.

On a completely tempered tool, this nitriding treatment does not increase the size of the tool. There have been many tests made in which the size of a tool, after nitriding, did not vary over .0001. If, however, the tool is not completely tempered, the treatment at 1050° F. for these periods may cause some change in the dimensions of the tool. This is not caused by the nitriding action, but by the transformation of austenite to martensite.

THE END.

Hard Chrome Plating by the Lundbye Process

LAST August, and again in December, THE TOOL ENGINEER reported remarkable increases in tool life obtained by hard chrome plating. The procedure was used by the Racine Plating Company, which has been prolonging tool life for several customers over a period of years.

Concurrently with the interest which the first of these articles stimulated, the Crowell-Collier Publishing Company announced the benefits of a chrome plating process developed to prolong the life of printing equipment formerly produced from Swedish steel. The phenomenal success of this process which had possibilities for broad application led the publisher to offer it, royalty free, to war industry. Increases in tool life have ranged from 300, 600 and 1200 to 2000 per cent.

Today, by writing to Mr. Thomas H. Beck, president of Crowell-Collier, 250 Park Avenue, New York, manufacturers of war products may obtain permission to send sample tools to the printing plant at Springfield, Ohio for plating. In return, Crowell-Collier requests a comparative report on tool operation. Further, Crowell-Collier will act as a consultant in designing an inexpensive plating plant.

●

Following is a description of the process originated by Mr. Axel Lundbye, chief engineer of the Springfield plant.

Assume that a tank is ready for the solution. A concentration of chromium trioxide (CrO_3) from 33 to 55 ounces will produce perfect plating. To obtain a bath with a concentration of 50 ounces of chromium trioxide, this amount is dissolved in water and 1/1000 of the weight of the chemical, or .50 ounces, of chemically pure concentrated sulphuric acid is added. The solution is made up to one gallon. These proportions hold for any quantity.

The solution must be heated before use—usually to a temperature of 125° to 140° F.—by lead steam coils, immersion heaters, or any of several ways, and the bath is ready.

A properly ground tool is cleaned in a steel tank or glass container with a 40 per cent solution of sodium or potassium hydroxide. This solution will also strip chrome when required. A caustic is used because it will not etch steel or cast iron.

The tool is left in the cleaning solution at 2 amperes per square inch for approximately 15 seconds. Rinsed in water, it is dipped in a 10 per cent hydrochloric acid solution for about 10 seconds. After washing again, the tool is ready for plating. It is fastened to a copper cross bar by means of a battery clip and is submerged in the plating bath ¼" above the cutting edge. Because the anode is made of lead, in the chrome bath, chrome metal is plated out of the solution.

Current is reversed for about 7 seconds to wet the surface of the tool and of course the tool is then the anode. The current is turned back, and plating takes place in the usual manner. Average plating time is between ¾ and 2 minutes at a current density of 1½ to 2½ amperes per square inch, depending upon the part to be plated. The tool is then removed, rinsed and submerged in an oil bath at 350° F. for one hour. This bath removes any hydrogen occluded in the chrome deposit, thus relieving strains set up during plating.

The tool then has a thin, dense, bright deposit of chromium, which will not chip or peel. It must be worn off in use, and before this is accomplished, life has been increased many times. It is economical to plate for eight hours and then collect the tools and submerge them in the oil treating tank. Any good grade of heavy heat transfer oil is satisfactory, it being used to minimize evaporation.

Chromium trioxide, popularly known as chromic acid, can be obtained without a priority, and should cost around 20 cents per pound.

Chrome-Plating Gages

PRECISION PLATING—HOW TO DO IT

L. W. MACOMBER

SUPERVISOR OF STANDARDS DEPARTMENT
LYNN RIVER WORKS
GENERAL ELECTRIC COMPANY

THE CUSTOMARY METHOD for producing new and salvaging worn gages has been to grind the gage several thousandths of an inch undersize, plate oversize, and then grind and lap to size—a total of four operations.

However, supplementary operations are required because plating is faster near the ends and at corners, thickness at these points being to two or three times normal. Also, the thicker the plate the more uneven it becomes. To overcome this, thieves or pieces of metal are attached to or adjacent to the ends of the parts being plated.

To streamline salvaging operations, experiments were started to produce a plate sufficiently uniform so that lapping alone would be necessary.

The problem was solved by using as thin a deposit as possible, and by carefully designing the thieves. As a result, thickness variations are consistently maintained to no more than .00002 inch with a deposit thickness of .00002 inch. Plating has been found to be hard and durable, and inexpensive. No flaking or chipping has been encountered, even when the plate has been worn entirely off in spots.

RECLAIMING PRECISION BLOCKS

Precision blocks worn more than .00002 inch are salvaged. They are first rough-lapped to minus .0002 inch in a lapping fixture which consists of two cast iron laps supported between adjustable plates, receiving any size block up to 4 inches. Adjusting nuts provide a means for maintaining parallelism. Conventional graded abrasives are used. Time of rough-lapping is less than 10 minutes per block.

Next, blocks are plated—.00015 to .0002 inch of hard chrome per surface. Checked for size, they are rough-lapped to about .00002 inch oversize. Finish lapping and measuring require about 30 minutes per block. Abrasive for finish lapping is settled in a 6-1 kerosene-olive oil mixture. It should remain in the mixture 30 minutes.

RECLAIMING CYLINDRICAL GAGES

Cylindrical gages are rough-lapped straight and round to .0002 to .0005 inch undersize. They are plated to about .0001 inch above maximum, measured and lapped to size.

Regular lapping procedure using ring laps may be used. However, a skilled man can do a good job with abrasive cloth in a lathe, providing the gage is round, he has good measuring equipment, and takes obvious precautions against rounding ends.

For liberal tolerance, and if plating is uniform, finish-lapping may be omitted, except for appearance. In this case, the plater aims for a thickness of plate which will make the gage maximum.

Plugs having a work tolerance of .0005 inch and a gage tolerance of .00005 inch that are worn undersize but are still round have been consistently salvaged by rough- and finish-lapping in a bench lathe with abrasive cloth, to a tolerance of .00001 or .00002 inch. Handling, lapping and measuring time is less than one hour per gage.

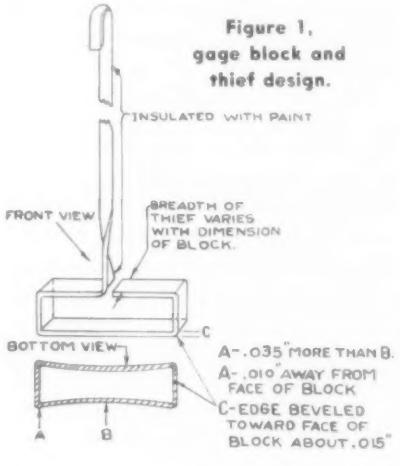


Figure 1, gage block and thief design.

PLATING PROCEDURE

Eight factors are involved in plating uniformly.

1. Proper work suspension.
2. Design and arrangements of anodes.
3. Accurate placement of anodes.
4. Proper design of thieves.
5. Proper cleaning procedure.
6. Proper temperature of solution.
7. Accurate current density.
8. Accurate time control.

Method of work suspension depends upon the shape involved. Some types of work are suspended from rods with wires, while others are specially racked. Precision blocks are held in thieves (Figure 1). Pin standards are supported in racks above the tank with only the ends immersed in the solu-

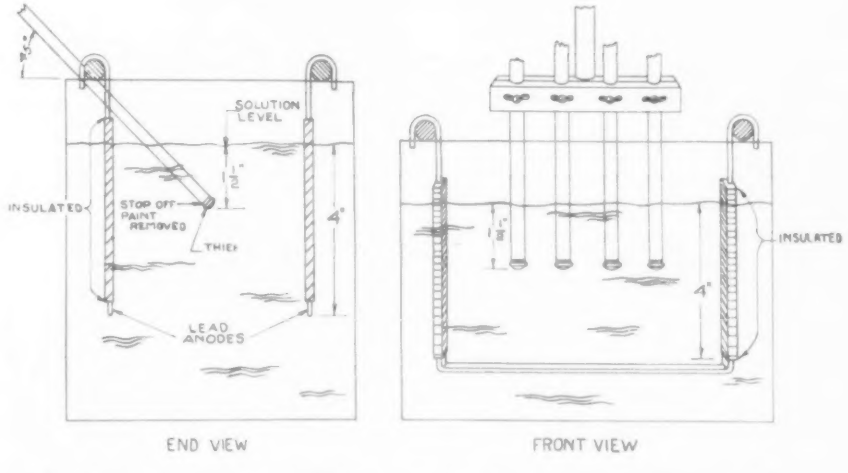


Figure 2, position of anodes for chrome plating master pin gages. Note design of thief in ring form on end.

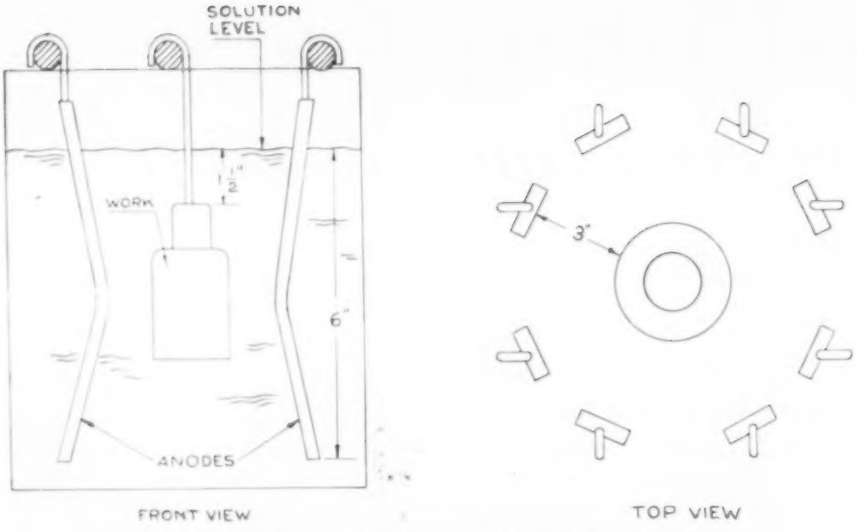


Figure 3, anode positions for plating cylindrical surfaces

tion (as illustrated in Figure 2).

Lead anodes are also designed to suit the shape of the work. They may be plates placed at four corners of a group of gages (Figure 2), a circular arrangement (Figure 3), or a ring surrounding a gage.

Figure 4 shows grouping of work and anodes for flat work such as precision blocks. Anodes must be symmetrical to the work, equidistant, and located usually 3 inches from the work surface.

The width of a thief, (which corresponds to the size of the block) is .035 inch wider at the ends or corners than at the center. It is also chamfered .015 inch on the inside edges. Different thief widths are not made for each block size in the smaller sizes, but are graduated in steps. A larger variety would provide closer control of plate.

Block Size	A. Center of Sides	B. At Ends or Corners
.050	.060	.095
.100-.115	.120	.155
.116-.130	.135	.170
.130-.149	.155	.190
.150-	.160	.195

From .150 inch to 1 inch, general design is the same. Above 1 inch, a half-thief is placed on both ends and the block is suspended from the center.

Thieves for cylindrical plug gages are steel cylinders, solid or tubular, ½ inch to 1 inch long and a diameter equal to the gage, to 1/16 inch larger. Ends adjacent to the gage are chamfered 1/16 inch. Thieves for pin standards are simple wire rings pressed on and placed even with the ends of the gage.

Cleaning and plating procedure is as follows:

First the rack and other parts not to be plated are dipped in special paint, two or three coats providing the insulation. Paint is then peeled from the gage and the active portions of the thieves.

Then:

1. Electro-clean 1 to 3 minutes with forward current in alkaline tank with steel anodes.
2. Electro-clean 5 to 15 seconds with reverse current.
3. Rinse in hot water.
4. Pickle 5 to 15 seconds in 20% HCL (Hydrochloric).
5. Rinse thoroughly in cold water.
6. Place in chrome-plating solution in proper position with respect to anodes.
7. 30 seconds reverse current at 2.5 amperes per square inch.
8. Plate at 2.5 amperes per square inch for predetermined length of time —solution at 55C.

Plating solution consists of 33 oz. per gallon CrO_3 (Anhydrous Chromic Acid) and .348 oz. per gallon of SO_4 (Sulphate Radical).

Theoretical calculations rarely led to the correct thickness of plate. Under definite conditions, the deposit was actually measured with precision methods to determine plating time per .0001 inch. Experimentation also showed that 30 seconds of reverse current under similar conditions removed .00004 inch of chromium or steel, which amount has to be added in calculating the plating time.

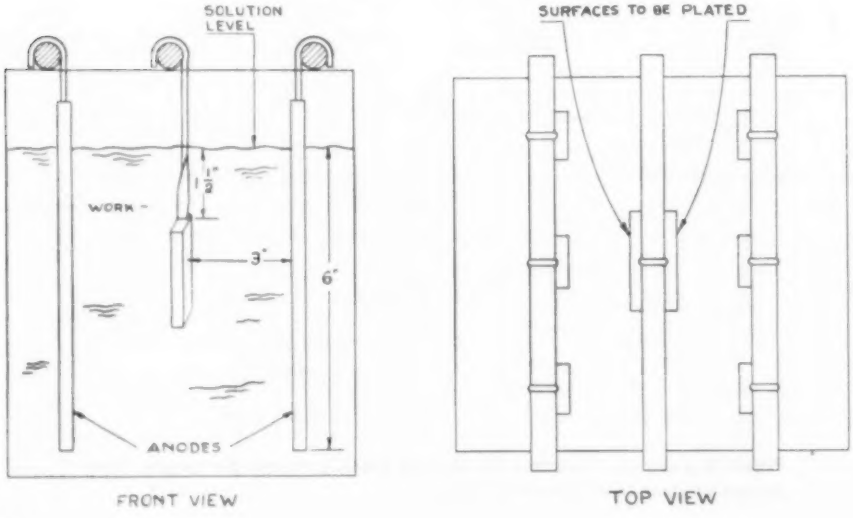
Generally, plating time has been nearly twice the theoretical value because of the presence of the thief in the circuit. The plating time for blocks, pins, and common gages has been found to be ten minutes per .0001 inch deposited.

It seems impossible to control group plating to desired accuracy, unless gages are identical, and the group no larger than four gages.

Best results are obtained by providing a separate current source, such as rectifier, for each gage being plated. Any number of circuits may be used in the same tank providing each uses an independent current source.

THE END.

Figure 4, anode positions for flat surface plating.



CORRECTION

Four typographical errors have been called to the attention of the editors of THE TOOL ENGINEER in connection with publication of "Wear Allowances and Tolerances for Inspection and Work Gages," in the January issue.

The legend on the chart on page 90 as published reads, C + 2 = 'No Go' wear allowance." This should read "C ÷ 2, or C/2."

In column three, lines 12 and 24, page 90, minus signs were used incorrectly. Figures should read ".250 + .0002" and ".2505 + .0002." In the chart on page 91, under column C at the bottom, type should read "For plug, ring & snap gages, not go wear allowances = go wear allowance divided by 2." The equality sign was omitted.

NEW METHODS ANNOUNCED:
Grinding and Brazing CARBIDE TOOLS

One of the toughest jobs in manufacturing carbide tools—grinding the top face—is now the simplest because of a new grinding process. Top face of tools may be ground at the rate of 80 to 100 an hour. Human element is eliminated in manipulating a tool and applying correct pressure.

•

Right:
Induction brazing cemented carbide tool with new electronic equipment.

General purpose equipment may benefit from design for automatic single purpose grinding machines for carbide tools (also applied to h.s.s.). Induction brazing method employs electronic control.

AT the invitation of the Carboloy Company, Inc., of Detroit, representatives of the technical and business press pre-viewed two developments for improving production and maintenance of carbide tipped tools.

One application consisted of a new tool grinding principle which may revolutionize the grinding of carbide cutting tools by making unnecessary the employment of highly skilled labor for this work, as well as by saving grinding wheels. The other is a development of electronic induction equipment for routine brazing of carbide tools, using any suitable brazing medium, including copper.

Automatic Grinding Control

To facilitate grinding of carbide tools, new principles have been developed cooperatively by the Carboloy Company and the Edison General Electric Company of Chicago. Though now applied only to single purpose machines in use at the "Hotpoint" plants, plans are going forward to develop more universal types.

Need for skilled or specially trained operators for carbide tools up to now has been required because:

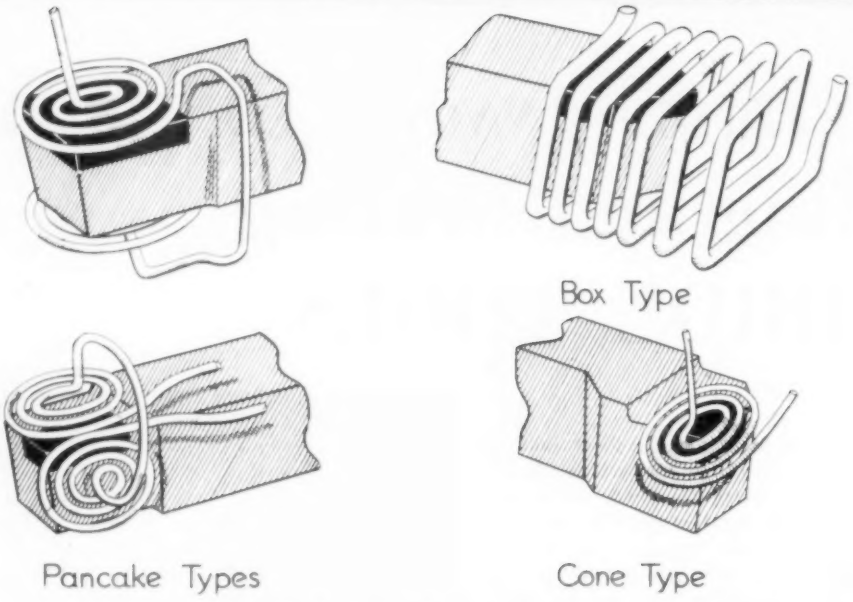
1. Sufficient pressure must be applied to the tool on the grinding wheel, but not so much that the tip will overheat.
2. The tool must be kept moving across the wheel to avoid localized overheating, to distribute wear on the wheel, and to obtain a good finish.
3. Carbide tools must always be ground toward rather than away from the cutting edge to prevent breaking out of small particles at the edge.
4. Angles to which carbide tools are ground should be held closer than with most high speed steel tools.

The new grinding process removes these factors from the direct control of the operator and incorporates them in automatic equipment. A single purpose machine was first developed to grind the top faces of standard carbide tools to relieve a serious shortage in grinder hands. Top faces of carbide tools are ground in from 8 to 30 seconds per tool, depending on size. Good average grinding time covering all faces is 25 seconds floor to floor—an output about six times that possible with a pedestal grinder.

Superior finish is obtained because the rotating grinding wheel also oscillates in the plane of the wheel while the tool is held stationary at the correct angle. Oscillation also contributes to speed.

Holding the tool against the wheel under constant and controlled pressure, insures maximum grinding speed consistent with quality of finish, wheel life and heat generated. Pressure is applied pneumatically. The tool is brought against the wheel under low pressure to remove jagged edges, the pressure automatically increasing to the pre-set amount. The time cycle is set by simple dial control, so that all the operator has to do is to insert the tool in the holder and remove it.

Automatic pressure control has per-



Sketches of typical coils used in induction brazing of carbide tips.

mitted replacing the usual resinoid wheels with metal-bonded, diamond-impregnated wheels, resulting in vastly increased wheel life. The difficulties in using this type wheel have previously centered about the fact that they require a higher tool pressure against the wheel, which mitigated against correct manual application.

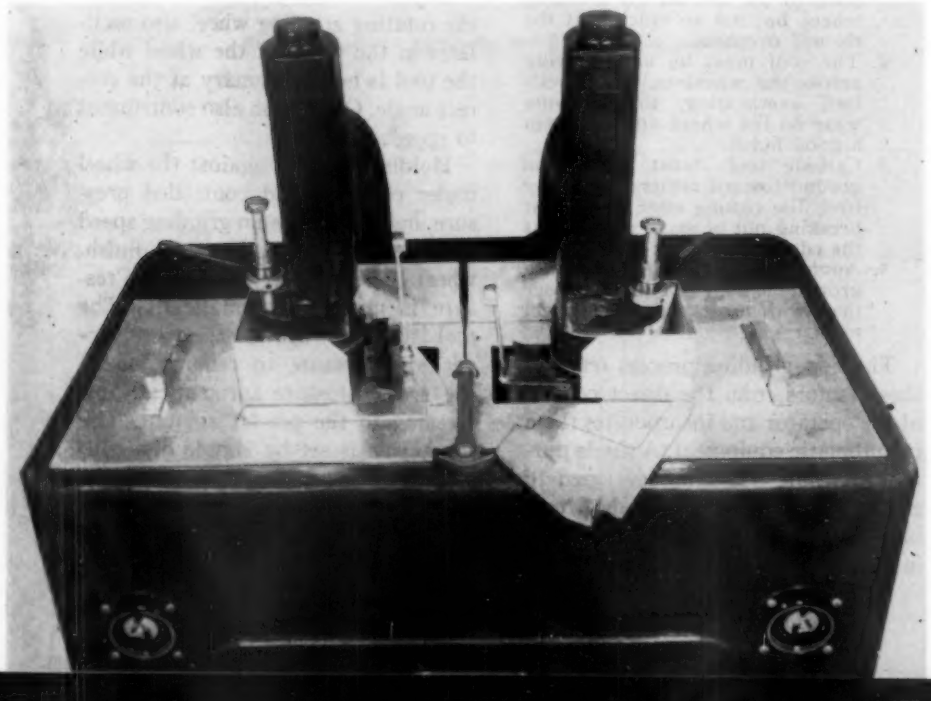
While developed for carbide tool grinding, the principles have already been applied in a limited way to grinding high speed steel tools.

When Hotpoint was required to cease electric range production, one of its plants was converted to manufacturing bullet cores. For machining these cores, many single purpose specialized form tools had to be sharpened daily.

While these tools were of high speed steel, it was found possible to design a slightly different version of the carbide grinder to handle them. Grinding the ends only, machines have paid for themselves in a few months' time, on the basis of grinding wheel cost alone.

Design development is being started to incorporate the new principles in general purpose tool grinders.

Specialized single purpose grinding equipment for sharpening h.s.s. form tools.



BRAZING CARBIDE TOOLS

ELECTRONIC induction equipment for brazing carbide tools, based on standardized units, is to be engineered to individual needs, recomdations being supplied by the Carboloy engineering department.

Among the advantages claimed for induction brazing of carbide tools are:

1. Convenience — brazing technique is simpler than when other furnace or torch brazing is used.
2. Speed — heating is confined to the actual area desired. Time required to braze a tool is cut from minutes to seconds.
3. Simplicity — unskilled labor can be used to braze carbide tools.
4. Accurate and automatic control —heat and distribution control prevents incomplete brazes or cracking of tips because of localized overheating.
5. Operating cost—one hundred average tools can be brazed for less than 10 cents total power cost. There are no furnaces to preheat.
6. Less brazing material needed—less flux is required than in other methods.
7. Cleaner brazes — no scale formation. Neutral atmosphere not required even for copper brazing except when silicon-manganese steel shanks are used.
8. Maintenance — fewer parts, and no moving parts are subject to wear.
9. Safety — while considerable power is passed through the heating coils, the nature of these high frequency currents is such that there is no danger involved.
10. Consistent brazes — for a given size tool, the same dial settings with the same coils, will always produce exactly the same amount and distribution of heat.

Using the electronic method, the operator merely attaches the correct coil for the tools to be brazed, sets the control dials on the oscillator to predetermined values as to current and time and pushes a button. In addition to the oscillator, the only equipment actually required to braze tools by the electron tube induction method is a table carrying a tool holding fixture or fixtures, and the necessary water-cooled coil or coils to be connected electrically to the oscillator.

Coils are simply fabricated in a few minutes from ordinary copper tubing. Depending on unit capacity, several coils may be hooked up in series. Experience has shown that it is not necessary to "puddle" a tip while it is being heated. It is usually only necessary to "seat it" with a rod after the current is off and the tool removed from the coil.

During the heating cycle, the steel shank heats faster than the tip. Just before the correct brazing temperature is reached however, the carbide tip reaches a somewhat higher temperature than the shank. This feature is desirable since maximum brazing effectiveness requires a slightly higher temperature for the carbide than for the steel. THE END.

Production Tool for PIERCING TUBING

THEODORE BIRKENMAIER
W. N. MATTHEWS CORPORATION

Production piercing of tubing walls presents problems in feed, fixture design, ejection of slugs and workpiece. Several designers have used conventional cam motion and vertical feed to provide clearance for ram and bolster. Dies were placed on an extended bolster so that tubes could be fed down the throat of the die and slugs be ejected by gravity.

Speeding production, a die has been designed which pierces 20 holes at one stroke and ejects slugs and workpiece by compressed air. After 400,000 tubes processed, the die is still producing satisfactorily. Rate of production per die averages 800 per hour.

Figure 1 shows the die installed in a Number 4½ Niagara Punch Press, with front and left sides visible. The air hose on the right side of the die is the medium for blowing out slugs, and is operated by the action of the ram through the adjustable bolt extended from the ram. A knock-out or stripping cylinder, not visible, is integral with the die shoe. It is operated by the up-stroke of the ram, which action causes a valve to open.

Design details are shown in Figure 3. Tubes are fed in and stop at the flange of the arbor. The press ram has a free movement of 1¼" before it contacts the punch holder of the die set. Because the space between punch guide bushings is limited, the stripper is frail and therefore must be stabilized. This is done with a cross-head assembly in which a 3/8" piece of drill rod is fastened to the cross-head of the piston which is equipped with a link carried up and down with the die head. The cylinder is stationary and only the cross-head stabilized rod and the stripper move with the head which is limited to 5/8" and is actuated by the springs inside of the die set and stopped by the stud as illustrated in the line drawing.

The whole assembly weighs about 100 pounds. The head weighs 15 pounds and a spare is maintained, so that when punches or arbor require repairs, the head can be removed from the die set, leaving the balance of the assembly in the press. This is simply accomplished by removing the six screws which hold the retaining plates of the slide plate.

THE END.

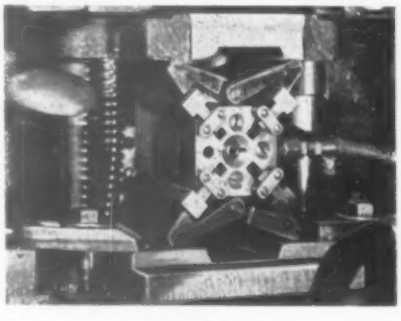


FIGURE 1.

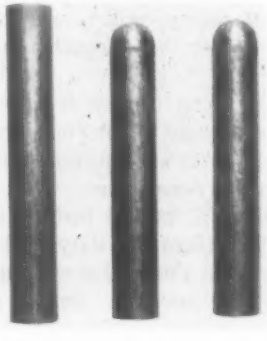
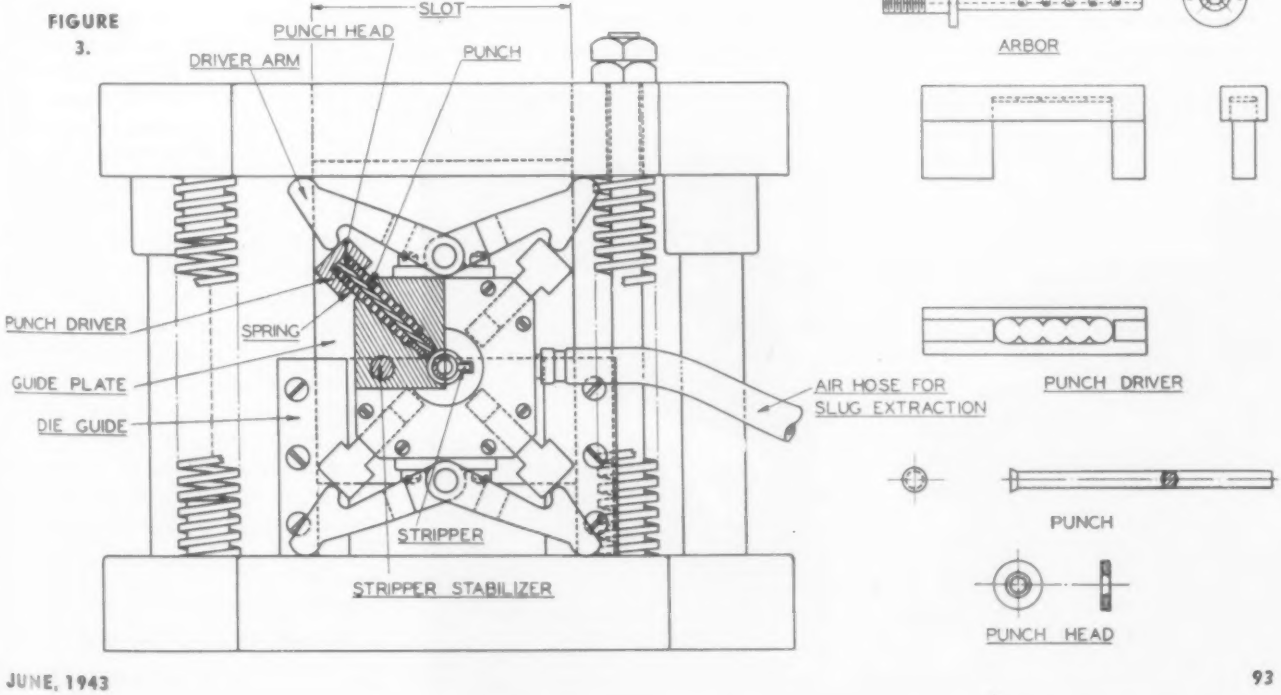


FIGURE 2 *(left)*:

Illustrating two unusual operations performed on tubing. The first, a method for closing the ends of tubing on a production basis, was explained in THE TOOL ENGINEER in the March issue. It consisted of an adaptation of the spinning method, for which Wolverine Tube of Detroit gained national acclaim. The second operation, explained in the present article, consists of piercing the tubing wall on production.

FIGURE 3.



RESISTANCE WELDING Below the Frost Line

A. L. MUNSON
FROSTRODE DIVISION
WELTRONIC CORPORATION

REFRIGERATION has become an essential tool in the fabrication of implements and materials of war. Among the important new uses found for refrigeration, its contribution to resistance welding is in the forefront.

The spectacle of two pieces of metal bristling with white frost coming together on two strips of aluminum, and making a weld, is spectacular and appeals to the imagination because it is so contrary to preconceived notions of natural phenomena. The two are so diametrically opposed — hot and cold. But that is just the combination that has made aluminum spot welding entirely practical in innumerable instances.

Fusing temperature, generated at the joint by the inherent resistance of the joint to the flow of an electric current, must develop fusion sufficient to maintain this attachment against the application of design loads to the parts.

In any resistance welding operation, the basic formula is expressed as: Heat equals I2RT, in which I is the secondary (or welding) current in amperes, R is the electrical resistance of the parts being welded, and T is the time required.

Three of the fundamental factors affecting this formula, are: current, time, and pressure — and any resistance welding machine must have means for accurately controlling these factors.

Current values for welding aluminum are three or more times the values used in welding steel of similar size. A spot welder designed to weld two pieces of 1/16" thick steel will not be heavy enough to weld the same size in aluminum.

Pressure can be applied by air or pneumatic cylinders. It must be adjustable since different types and sizes of materials require widely varying pressure between the electrodes and the work.

Accurate timing control is essential in any resistance welding machine. Electronic controls are affording high accuracy in this development, by providing timing in 'cycles' instead of seconds. Since there are sixty cycles in each second in a normal power supply, it is obvious that timing is possible to 1/60th of a second.

In order to make a weld a welding machine must be carefully arranged to perform certain definite functions in a certain sequence — as determined by setting in control panel. Current cannot be permitted to pass thru the electrodes until they have been brought together on the work under the proper pressure. Therefore the machine sequence would normally be:

Squeeze time—Bring points together and hold them together under pressure for a definite time.

Weld Time—(Often broken up into a series of pulsations of heat time, cool time, etc., as for steel). The duration of welding current. In aluminum welding this time is a fraction of one cycle since a high current is used and must be of very short duration—due to the nature of the material).

Hold Time — Points must remain closed ater current flow has stopped to give metal chance to fuse and cool. Sometimes called forging pressure.

Off time—When automatic operation is desired there must be an off time to allow moving work to a new spot location—to be ready for another weld.

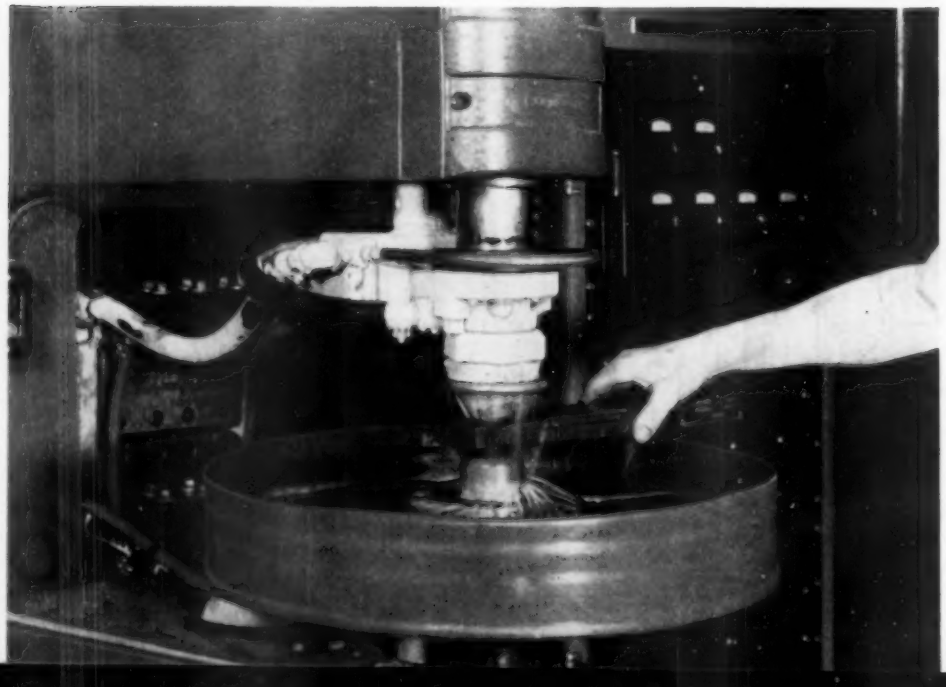
With synchronous timing controls, each timing cycle is begun at that point on the sine curve where it is zero in current value. This eliminates sudden line surges.

Before a weld can be made, the work must be cleaned and otherwise prepared. The purpose of surface preparation is to eliminate wide variations in the heat of welding caused by great variations in the contact surface resistance — and also to reduce the heating between work and electrodes. Work can often be ruined by improper treatment or cleaning, and in aluminum work, premature pick-up will result. And since aluminum has the unhappy faculty of picking up soon enough even with proper cleaning, this factor is given serious attention by all good welding engineers.

The surface resistance of aluminum sheets is caused by the pressure on the sheet of foreign substances such as may be deposited by handling or by some chemical action of atmosphere. Fumes, smoke and moisture will have definite effects on the oxide coating. Dirt, grit and dust will also cause some trouble and can often limit the number of spots obtainable.

Aluminum alloys readily alloy

Armor plate subjected to tempering chill, following welding. Water spray is refrigerated. A thermocouple buried in the lower electrode controls the amount of heat put into the weld accurately, and also controls the chilling cycle.



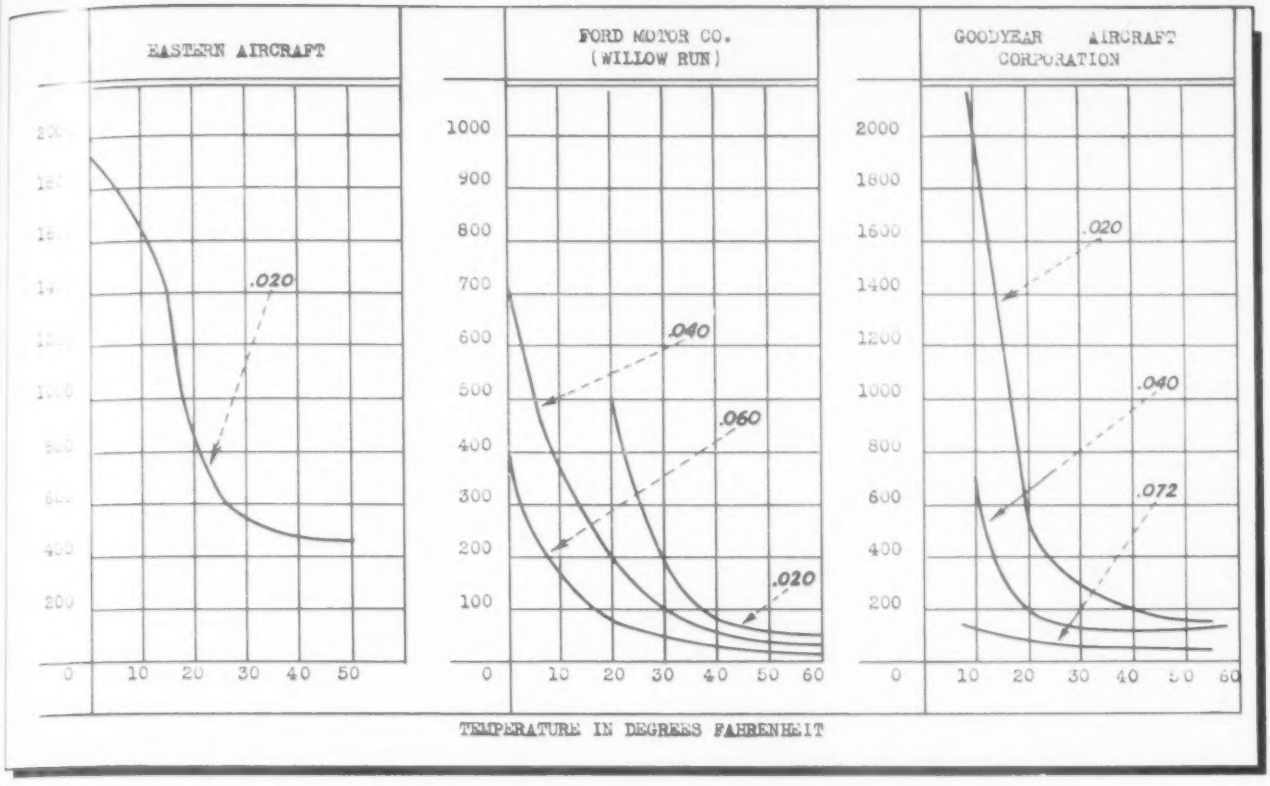


Chart showing number of successful spot welds made with one set of electrodes between dressings on various gauges of aluminum at varying temperatures of welder electrode tips. Production conditions are taken from three aircraft plants. Projection of graphs beyond 0° F. mark shows a leveling off in number of spots to such a degree that lower temperatures prove no more satisfactory. Eastern Aircraft Division of General Motors testified that the introduction of refrigerated tips had resulted in a gain of 300% in the operation of spot welders.

with copper, *especially* at high temperatures. It is therefore important that the temperature of the copper electrode face, which is in contact with the aluminum, be kept as low as possible.

This is the basic reason for the use of refrigeration. We try to hold this *face temperature* down below the fusion or alloying point in order to retard alloying, or 'pick-up'. If we could successfully do that we might be able to weld forever on one set of electrodes.

Refrigeration also assists materially in retarding the so-called 'mushrooming' of electrodes. Heat and pressure and constant pounding together, cause distortion in the shape of the electrode, at the face.

Two commonly used cleaning methods are chemical cleaning and mechanical cleaning. Each method has its boosters and very often the nature of the job (or shape) will determine which method to use.

Extreme uniformity can be obtained with chemical cleaning and this is important because without uniformity, it is impossible to reproduce equally consistent welds. No skill is required by workers since they need only load and unload the tanks on a definite schedule. Time of dipping in bath must be controlled to obtain the high uniformity desired and possible. More spots can be obtained usually, between point dressings.

Mechanical cleaning requires skilled operators usually because care must be exercised in removing oxide coating so as not to thin the Alclad, or rough up the surface of the sheet. However, this method allows cleaning of any part of a surface without necessity of treating entire surface. Initial equipment required is small and inexpensive. While cleaning may not be as uniform, careful operators can obtain satisfactory results.

Now, with the welding machine properly set for the work to be done, and the work properly cleaned, welding operations can begin. Many samples are made first, to check the control settings. Shear strengths must meet rigid specifications. Too much current will cause 'spitting' or burning. Serious accidents can result when molten metal splatters from the weld. Not enough pressure will also cause 'spitting'. Too much pressure causes objectionable indentations in the sheet. Too little heat means weak welds.

This brief summary of welding practice will indicate what we are up against when we try to apply refrigeration to a welding machine. It is essential to know welding before attempting to apply refrigeration to this complicated welding procedure. There is no easy way to determine refrigeration loads. Each size sheet requires different heat. The condition of the sheet will cause variations. Each alloy

Refrigerating electrodes for resistance welding of aluminum prevents fusion of copper and aluminum and prolongs life of electrodes, because the cool points do not readily mushroom. Refrigeration has also facilitated welding of armor plate.

will be different. The condition and type of electrodes will cause very wide variations. The throat depth and height must be considered. Any ferrous metal in the throat field will make a difference. Methods of cleaning and consistency of cleaning are important. Atmospheric conditions are important. Polarity of electrodes is important.

Cooling surface available in electrode is of utmost importance. Coolant flow and volume of coolant are also very important.

All these and more must be carefully considered when refrigeration is to be applied to welding. It is essential to know the welding equipment before even the loads involved can be properly determined because each type of welding machine is different in operating characteristics. The variables encountered are staggering and only welding knowledge and long experience in this application can hope to solve them successfully. Many structural parts are being spot welded today. This would have brought horror-stricken protests not so very long ago. When properly designed and applied, refrigeration can work miracles in speeding aluminum fabrication in spot welding. And since spot welding is so much easier and speedier than riveting — it's like using a sewing machine on sheets of aluminum.

But is refrigeration really worthwhile? There has unfortunately been some conflicting evidence in the welding industry on this. There have been papers pro and con which have tended to confuse. Some plants say it isn't worth the extra cost — that the improvement is not great enough. However it has been our experience, that when properly applied refrigeration has almost invariably showed considerable and worthwhile improvements — often 500% improvement and sometimes much more.

VARIATION IN RESULTS

Perhaps the greatest cause of variations in results obtained are caused by the human element plus the varying machine characteristics and different cleaning conditions. All the variables mentioned above enter into this too and in greater or lesser degree determine the results to be obtained. Preconceived notions, prejudices, and occasional lack of cooperation of the operators or welding machines causes a wide variation in welding heat, and consequently in results obtained. Time interval between cleaning and welding can make a big difference. As many as 2,000 spot welds on .064" 24ST Alclad have been made between cleanings with proper electrodes. The shear tests were unusually consistent and the welds were entirely acceptable. Field production tests have shown 600 to 900 spots on the same material between cleanings, on the stored energy type welder, which is more difficult to cool. Previously 30 spots or 50 spots were considered a good average.

The best coolant temperature we have found to be between 0°F and 10°F. A minimum of 2 GPM must be circulated in each electrode. However there is some evidence that indicates that for light gauges of aluminum, a temperature of 15° or 20° F works very well (.020). But we have standardized on 0° since in by far the most cases, it has given much better results. For steel work, we often use 40°F, such as in Gun type welders. But even for steel we have found 0°F very desirable in many cases, such as for the Temp-O-Trol Welder made by Progressive Welder Company which permits accurate heat treating after welding, since all heat is accurately controlled by a thermocouple inside one of the electrodes. Armor plate can be very successfully welded and heat treated after welding with this unit.

A series of pulsating electrical currents of varying intensity are used so that any predetermined degree of heat can be obtained accurately and consequently it is quite simple to obtain approximately the same hardness and toughness in the weld as was in the original metal. Refrigerated electrodes assist in the quick quenching and also greatly retard point mushrooming.

Refrigerated electrode tips are commonly dressed with a file and/or oxalite paper of fine texture abrasive. This cleaning is one of the worst headaches since it occupies so much valuable production time. It usually takes from five to as much as twenty minutes to clean one set of points.

Refrigeration increases the current carrying capacity of the electrode at low temperatures. Refrigeration has no appreciable effect on shear strengths. It is important that equal amounts of refrigeration be supplied to each electrode to secure uniform results.

The weld nugget should be between 60 per cent and 80 per cent penetration. If the weld penetrates the surface of the sheet, no amount of refrigeration will keep the melting metal cool.

The current required for an aluminum sheet weld is less than one cycle in duration. Prolonged heating at less intensity would cause sheet buckling and poor welds.

In portable gun welders we often cool the welding cables and also the welding transformer. It provides much longer equipment life and makes the welder entirely independent of water supply. THE END.

Here, a welding set-up has been adapted to performing an upset job. Quarter inch iron rods are heated and pressed into countersunk holes. By cooling the electrodes, life is increased five or six times.

PRODUCTION DATA SHEET

CAPACITIES OF HYDRAULIC RAMS IN TONS

Dia.	PRESSURE IN POUNDS PER SQUARE INCH																					Gal. per inch	Gal. per ft.	Area	Dia.
	300	500	600	750	1000	1200	1500	1800	2000	2250	2500	2750	3000	3500	4000	4500	5000	5500	6000	6500	7000				
1	0.12	0.20	0.24	0.29	0.39	0.47	0.59	0.71	0.79	0.88	0.98	1.08	1.18	1.37	1.57	1.77	1.96	2.16	2.36	2.55	2.76	.003	.041	0.79	1
1¼	0.27	0.44	0.53	0.66	0.88	1.06	1.33	1.59	1.77	1.99	2.21	2.43	2.65	3.09	3.53	3.98	4.42	4.86	5.30	5.74	6.19	.008	.092	1.77	1¼
2	0.47	0.79	0.94	1.18	1.57	1.88	2.36	2.83	3.14	3.53	3.93	4.32	4.71	5.50	6.28	7.07	7.85	8.64	9.42	10.2	11.0	.014	.163	3.14	2
2½	0.74	1.23	1.47	1.84	2.45	2.95	3.68	4.42	4.91	5.52	6.14	6.75	7.36	8.59	9.82	11.0	12.3	13.5	14.7	16.0	17.2	.023	.255	4.91	2½
3	1.06	1.77	2.12	2.65	3.53	4.24	5.30	6.36	7.07	7.95	8.84	9.72	10.6	12.4	14.1	15.9	17.7	19.4	21.2	23.0	24.7	.031	.367	7.07	3
3½	1.44	2.41	2.89	3.61	4.81	5.77	7.22	8.66	9.62	10.8	12.0	13.2	14.4	16.8	19.2	21.6	24.1	26.5	28.9	31.3	33.7	.042	.500	9.62	3½
4	1.88	3.14	3.77	4.71	6.28	7.54	9.42	11.3	12.6	14.1	15.7	17.3	18.8	22.0	25.1	28.3	31.4	34.6	37.7	40.8	44.0	.054	.653	12.6	4
4½	2.39	3.98	4.77	5.96	7.95	9.54	11.9	14.3	15.9	17.9	19.9	21.9	23.9	27.8	31.8	35.8	39.8	43.7	47.7	51.7	55.7	.069	.826	15.9	4½
5	2.95	4.91	5.89	7.36	9.82	11.8	14.7	17.7	19.6	22.1	24.5	27.0	29.5	34.3	39.3	44.2	49.1	54.0	58.9	63.8	68.7	.085	1.02	19.6	5
5½	3.56	5.94	7.13	8.91	11.9	14.3	17.8	21.4	23.8	26.7	29.7	32.7	35.6	41.6	47.5	53.5	59.4	65.3	71.3	77.2	83.2	.103	1.33	23.8	5½
6	4.24	7.07	8.48	10.6	14.1	17.0	21.2	25.4	28.3	31.8	35.3	38.9	42.4	49.5	56.5	63.6	70.7	77.8	84.8	91.9	99.0	.122	1.47	28.3	6
6½	4.98	8.30	9.96	12.4	16.6	19.9	24.9	29.9	33.2	37.3	41.5	45.6	49.8	58.1	66.4	74.7	83.0	91.3	99.6	108	116	.144	1.72	33.2	6½
7	5.77	9.62	11.5	14.4	19.2	23.1	28.9	34.6	38.5	43.3	48.1	52.9	57.7	67.3	77.0	86.6	96.2	106	115	125	135	.167	2.00	38.5	7
7½	6.63	11.0	13.3	16.6	22.1	26.5	33.1	39.8	44.2	49.7	55.2	60.7	66.3	77.3	88.4	99.4	110	121	133	144	155	.191	2.30	44.2	7½
8	7.54	12.6	15.1	18.8	25.1	30.2	37.7	45.3	50.3	56.5	62.8	69.1	75.4	88.0	101	113	126	138	151	163	176	.218	2.61	50.3	8
8½	8.51	14.2	17.0	21.3	28.4	34.0	42.6	51.1	56.7	63.8	70.9	78.0	85.1	99.3	113	128	142	156	170	184	199	.246	2.95	56.7	8½
9	9.54	15.9	19.1	23.9	31.8	38.2	47.7	57.3	63.6	71.6	79.5	87.5	95.4	111	127	143	159	175	191	207	223	.275	3.30	63.6	9
9½	10.6	17.7	21.3	26.6	35.4	42.5	53.2	63.8	70.9	79.7	88.6	97.5	106	124	142	159	177	195	213	230	248	.307	3.68	70.9	9½
10	11.8	19.6	23.6	29.5	39.3	47.1	58.9	70.7	78.5	88.4	98.2	108	118	137	157	177	196	216	236	255	276	.340	4.08	78.5	10
11	14.3	23.8	28.5	35.6	47.5	57.0	71.3	85.5	95.0	107	119	131	143	166	190	214	238	261	285	308	333	.411	4.94	95.0	11
12	17.0	28.3	33.9	42.4	56.5	67.9	84.8	102	113	127	141	156	170	198	226	254	283	311	339	368	396	.490	5.88	113	12
13	19.9	33.2	39.8	49.8	66.4	79.6	99.5	119	133	149	166	183	199	232	265	299	332	365	398	431	465	.575	6.90	133	13
14	23.1	38.5	46.2	57.7	77.0	92.4	115	139	154	173	192	212	231	269	308	346	385	423	462	500	539	.666	8.00	154	14
15	26.5	44.2	53.0	66.3	88.4	106	133	159	177	199	221	243	265	309	353	398	442	486	530	574	619	.765	9.18	177	15
16	30.2	50.3	60.3	75.4	101	121	151	181	201	226	251	276	302	352	402	452	503	553	603	653	704	.870	10.4	201	16
17	34.0	56.7	68.1	85.1	113	136	170	204	227	255	284	312	340	397	454	511	567	624	681	738	794	.983	11.8	227	17
18	38.2	63.6	76.3	95.4	127	153	191	229	254	286	318	350	382	445	509	573	636	700	763	827	891	1.10	13.2	254	18
19	42.5	70.9	85.1	106	142	170	213	252	284	319	354	390	425	497	567	638	709	780	851	921	992	1.23	14.7	284	19
20	47.1	78.5	94.2	118	157	188	236	283	314	353	393	432	471	550	628	707	785	864	942	1021	1100	1.36	16.3	314	20
21	52.0	86.6	104	130	173	208	260	312	346	390	433	476	520	606	693	779	866	952	1039	1126	1212	1.50	18.0	346	21
22	57.0	95.0	114	142	190	228	285	342	380	428	475	523	570	665	760	855	950	1045	1140	1235	1330	1.65	19.7	380	22
23	62.3	104	125	156	208	249	312	373	415	467	519	571	623	727	831	935	1039	1143	1246	1350	1454	1.80	21.6	415	23
24	67.9	113	136	170	226	271	339	407	452	509	565	622	679	792	905	1018	1131	1244	1357	1470	1583	1.96	23.5	452	24
25	73.6	123	147	184	245	295	368	442	491	552	614	675	736	859	982	1104	1227	1350	1473	1595	1718	2.13	25.5	491	25
26	79.6	133	159	199	265	319	398	478	531	597	664	730	796	929	1062	1195	1327	1460	1593	1726	1858	2.30	27.6	531	26
27	85.9	143	172	215	286	344	429	515	573	644	716	787	859	1002	1145	1288	1431	1575	1718	1861	2004	2.48	29.7	573	27
28	92.4	154	185	231	308	369	462	554	616	693	770	847	924	1078	1232	1385	1539	1693	1847	2001	2155	2.67	32.0	616	28
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31	113	189	226	283	377	453	566	678	755	849	943	1038	1132	1321	1510	1698	1887	2076	2264	2453	2642	3.27	39.2	755	31
32	121	201	241	302	402	483	603	724	804	905	1005	1106	1206	1408	1608	1810	2011	2212	2413	2614	2816	3.48	41.8	804	32
33	128	214	257	321	428	513	641	770	855	962	1069	1176	1283	1497	1711	1924	2138	2352	2566	2780	2994	3.70	44.4	855	33
34	136	227	272	340	454	545	681	817	908	1021	1135	1248	1362	1589	1816	2043	2270	2497	2724	2951	3178	3.94	47.2	908	34
35	144	241	289	361	481	577	722	866	962	1082	1203	1323	1443	1684	1924	2165	2405	2646	2886	3127	3367	4.17	50.0	962	35
36	153	254	305	382	509	611	763	916	1018	1145	1272	1400	1527	1781	2036	2290	2545	2799	3054	3308	3563	4.41	52.9	1018	36
37	161	269	323	403	538	645	806	968	1075	1210	1344	1478	1613	1882	2150	2419	2688	2957	3226	3494	3763	4.65	55.9	1075	37
38	170	284	340	425	567	680	851	1021	1134	1276	1418	1559	1701	1985	2268	2552	2835	3119	3402	3686	3969	4.91	58.9	1134	38
39	179	299	358	448	597	717	894	1075	1195	1344	1493	1643	1792	2091	2389	2688	2986	3285	3584	3882	4181	5.17	62.1	1195	39
40	188	314	377	471	628	754	942	1131	1257	1414	1572	1728	1885	2199	2513	2827	3142	3456	3770	4084	4398	5.44	65.3	1257	40
41	198	330	396	495	660	792	990	1188	1320	1485	1650	1815	1980	2310	2641	2971	3301	3631	3961	4291	4621	5.72	68.6	1320	41
42	208	346	416	520	693	831	1039	1247	1385	1559	1732	1905	2078	2425	2771	3117	3464	3810	4156	4503	4849	6.00	72.0	1385	42
43	218	363	436	542	726	871	1089	1307	1452	1634	1815	1997	2178	2541	2904	3267	3631	3994	4357	4720	5083	6.29	75.4	1452	43
44	228	380	456	570	760	912	1140	1368	1521	1711	1901	2091	2281	2661	3041	3421	3801	4181	4562	4942	5322	6.58	79.0	1521	44
45	239	398	477	596	795	954	1193	1431	1590	1789	1988	2187	2386	2783	3181	3578	3976	4374	4771	5169	5567	6.89	82.6	1590	45
46	249	415	499	623	831	997	1246	1496	1662	1870	2077	2285	2493	2908	3324	3739	4155	4570	4986	5401	5817	7.19	86.3	1662	46
47	260	434	520	651	867	1041	1301	1561	1735	1952	2169	2386	2602	3036	3470	3904	4337	4771	5205	5639	6072	7.51	90.1	1735	47
48	271	452	543	679	905	1086	1357	1629	1810	2036	2262	2488	2714	3167	3619	4072	4524	4976	5429	5881	6333	7.83	94.0	1810	48
49	283	471	566	707	943	1131	1414	1697	1886	2121	2357	2593	2829	3300	3771	4243	4714	5186	5657	6129	6600	8.16	98.0	1886	49
50	295	491	589	736	982	1178	1473	1767	1963	2209	2454	2700	2945	3436	3927	4418	4909	5400	5890	6381	6872	8.50	102	1963	50
52	319	531	637	796	1060	1270	1590	1910	2120	2390	2650	2920	3190	3720	4250	4780	5310	5840	6370	6900	7430	9.19	110	2124	52
54	344	573	687	859	1150	1370	1720	2060	2290	2580	2860	3150	3440	4010	4580	5150	5730	6300	6870	7440	8020	9.91	119	2290	54
56	369	616	739	924	1230	1480	1850	2220	2460	2770	3080	3390	3690	4310	4930	5540	6160	6770	7390	8000	8620	10.7	128	2463	56
58	396	660	793	991	1320	1590	1980	2380	2640	2970	3300	3630	3960	4620	5280	5940	6600	7270	7930	8590	9250	11.4	137	2642	58
60	424	707	848	1060	1410	1700	2120	2540	2830	3180	3530	3890	4240	4950	5650	6360	7070	7780	8480	9190	9900	12.2	147	2827	60
	.175	.292	.350	.438	.583	.700	.875	1.05	1.17	1.31	1.46	1.60	1.75	2.04	2.33	2.62	2.92	3.21	3.50	3.79	4.08	H. P. per gal. per min.			

Courtesy Charles F. Elmes Engineering Works

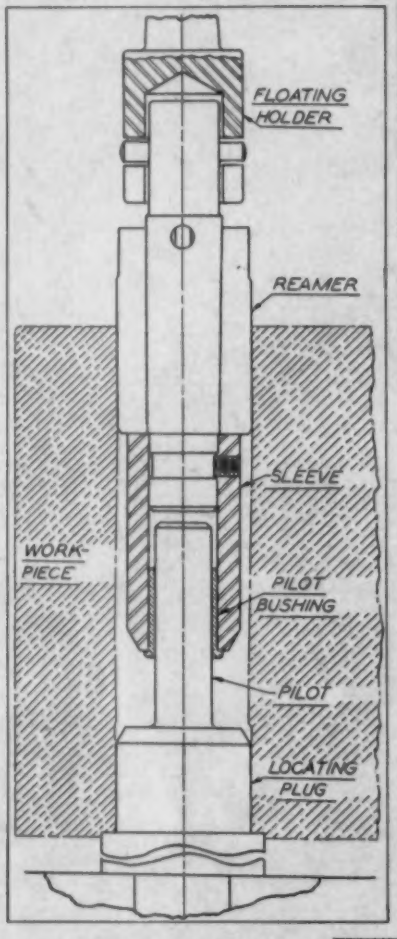
NOTE: On this page is the twentieth of a series of Data Sheets to be published in THE TOOL ENGINEER. A handy three ring binder can be secured at any dime store to hold the sheets for quick reference.

The CRIB*

IDEAS • KINKS • SHORT CUTS

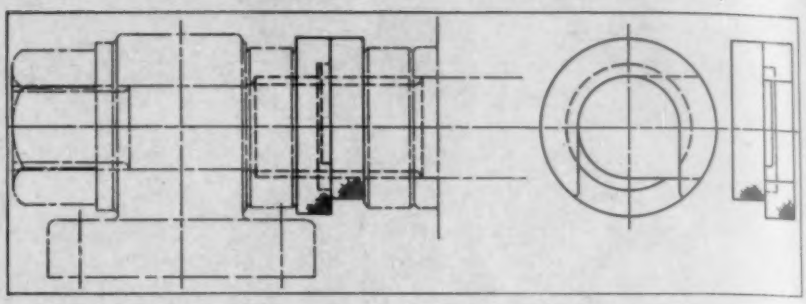
*T.M. REG. U.S. PAT. OFF.

Floating Reamer for Opposed Holes



SHORT opposed holes should be reamed with a floating reamer, opposite hole being located in a plug. While there will be some play when the workpiece is reversed, as from rough to finished end, the float will compensate.

However, the roundness of the hole is usually improved by piloting the reamer, as by the simple method shown. The stationary vertical pilot is easily cleared of chips which cannot collect during operation, because of the inverted position of the pilot and the bushing.



Improved U-Washer Will Not "Walk"

THE ordinary U-washer has a tendency to walk as nuts are tightened, going in the line of least resistance.

The two-piece washer shown above, while slightly slower in application, obviates this defect.

As shown, the halves are made grooved and tongued (male and female) and either is given a right angle turn after placing on shaft or stop rod. Then, they junction as a single, circular washer.

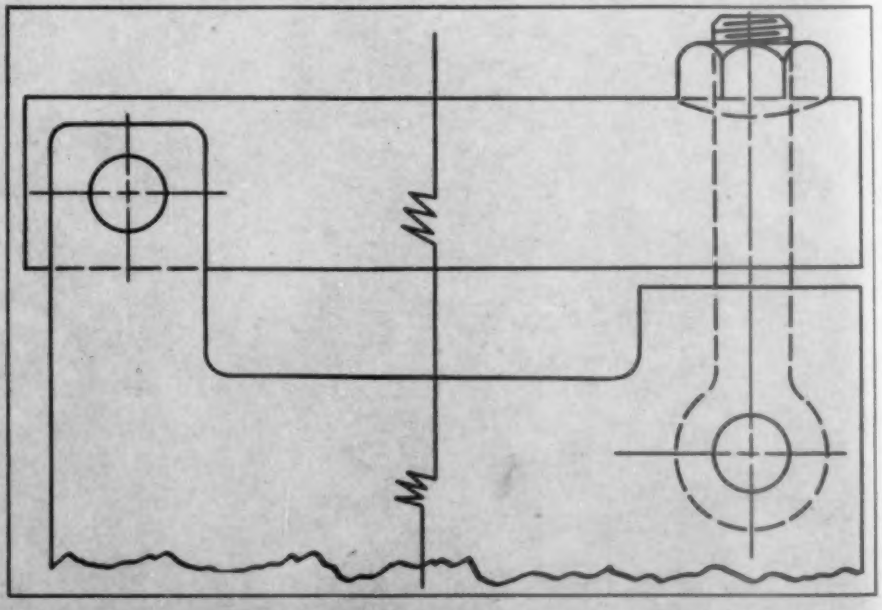
Magnetized Drill Prevents Chip Jams

CHIPS will not jam and break a magnetized drill as easily as otherwise, according to slightly inconclusive reports. Chief disadvantage seems to lie in cleaning drill.

Every good production engineer has devised shop short-cuts, or added to his plant's 'know-how.' Send ideas to THE TOOL ENGINEER for publication for pay.

Insures Seating of Nuts on Swing Clamp

TO INSURE the seating of nuts on swing clamps, provide a convex ball radius on the nut and a corresponding concave ball seat in the clamp. They "stay put"—no crawl.



DO YOU REALLY KNOW — YOUR BAR TURNER?

Here's How You Can Learn the Full Possibilities of Your Bar Turner

ONE of the most important tools employed in metal turning is the Warner & Swasey Single Cutter Bar Turner. It is used more than any tool on turret lathes set up for bar work.

Field studies in dozens of plants indicated the urgent need for a better understanding of the several fundamentals governing the setup and operation of this tool.

The information and many helpful hints assembled in the new Warner & Swasey booklet, "Better Performance from Single Cutter Bar Turners", can improve performance of this basic turret lathe tool and increase production in your shop.

Just issued — new 32-page illustrated booklet shows how to make the most efficient use of the Single Cutter Turner on bar work.

GET IT QUICKLY BY USING THE CONVENIENT COUPON

Warner & Swasey Operator's Service Bureau, Cleveland, Ohio

Please send booklet, "Better Performance from Single Cutter Bar Turners".

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Company _____

Address _____

City _____ State _____

I work at (Company) _____

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Turret Lathes
Cleveland

OU CAN TURN IT BETTER, FASTER, FOR ESS . . . WITH A WARNER & SWASEY

STARRETT HACKSAWS

THE "MAKE" OF HACKSAWS IS DOUBLY IMPORTANT NOW!

Make all the comparative cutting tests and check-ups you wish — if you have the time. Starrett Blades will come through with flying colors.

But if you must have fast cutting, long lasting blades right along and no fooling, it's an awfully good idea to stick to blades that carry a name like STARRETT. They've got a reputation to uphold that dates a long way back and looks a long way ahead... *STARRETT makes the right blade for the job* — Standard Steel for hand sawing, S-M Molybdenum for fast cutting and long life on both power and hand work, High Speed Steel for power sawing of extra hard alloy steels... Ask your mill supply distributor for STARRETT Hacksaws.

...and that goes for BANDSAWS, too!

The name STARRETT has equal significance when you need unquestioned performance from Metal Cutting Bandsaws. Starrett hard edge, flexible back Bandsaws are made in 12 widths (3/32" to 1"), 3 gauges and 8 pitches — in coils of any length or cut to length and welded.

Ask your mill supply distributor for STARRETT Bandsaws.

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Men, Materials and Machines

•

CONVEYORS Speed Aircraft Wing Manufacture

THE continuous-motion assembly line, dramatic symbol of American mass production, has been successfully applied to aircraft fabrication.

Most conspicuous user of the power-driven line before the war was the automobile industry. Consequently, the adaptation of this manufacturing technique by the aircraft industry is newsworthy in itself, for The Bell Aircraft Corporation believes that its conveyorized fabrication of airplane wings antedated the utilization of conveyors for this type of work by auto concerns now mass producing similar aircraft parts.

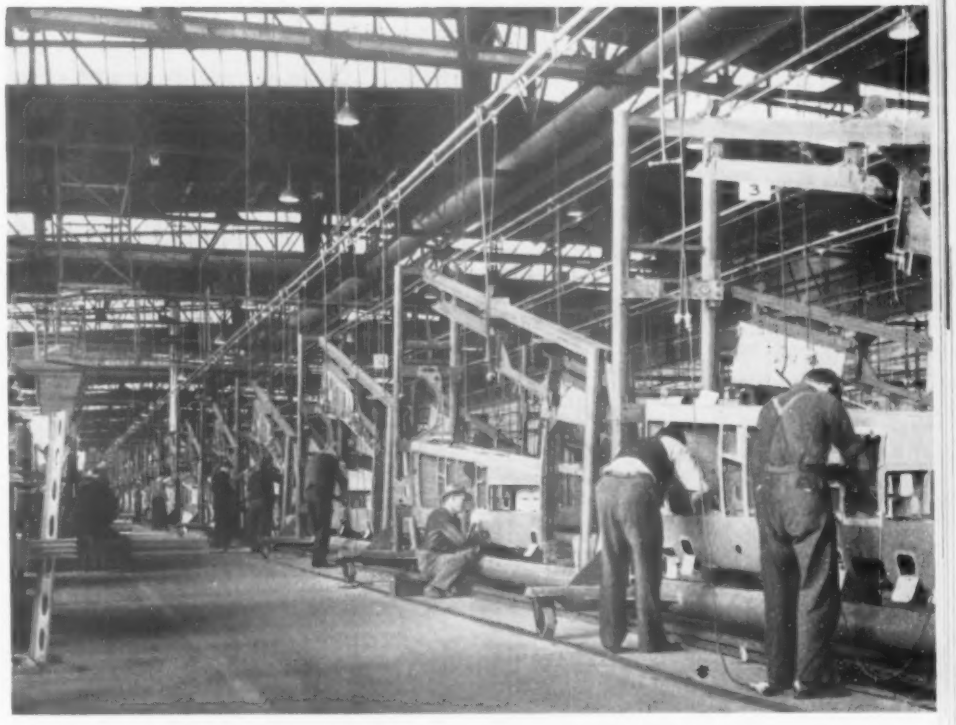
Adoption of the moving conveyor line effects progressive assembly of all component parts of a unit-structure. By this process, raw materials must be transformed into parts, parts into subassemblies and subassemblies into a finished product, all as a continuous and uninterrupted operation.

Constant-motion assembly lines have been used in the aircraft industry for several years. Actually, work on these lines consisted largely of attaching parts and installing electrical and hydraulic systems as the ships approached the final stages of completion. Bell also is credited with pioneering this system, having applied continuous motion to its Army P-39 Airacobra fuselage assembly lines early in 1941.

The most recent forward step taken by this aircraft mass producer has been the installation of a system whereby wings are actually fabricated progressively in huge master fixtures which move steadily forward on a power-driven drag chain conveyor.

Similar work now is being performed in Detroit, but Bell's installation is believed to be the first conveyorized, straight-line production of combat aircraft wings in a single holding fixture.

So well planned is the overall operation that the entire job of assembling 18-foot-long Airacobra wings is performed by women, aided by a



Dolly fixtures holding Airacobra wings are moved along a motorized conveyor chain in the floor at Bell Aircraft Corporation. From Station 3, wings are seen taking shape as they pass through various stations to receive additional parts.

Bell Aircraft Photos

Bell Aircraft, producer of the cannon-carrying Airacobra, pioneered the use of moving fuselage assembly lines. Now, this production-wise organization has conveyorized its big wing fixtures

•

WALLACE A. SCOTTEN
ASSOCIATE EDITOR

Right and left hand wings move down parallel lines in Bell's conveyorized wing plant at Buffalo.

Floors are clear as all electric and pneumatic tools are suspended from overhead, saving time and materials.

few lead men. Substantial savings in time and manpower have resulted from the use of the single fixture instead of the four previously used. By the old method, wing members were bolted in place and positioned in each fixture, removed from the fixture when the operation was completed and moved by hand to the next fixture.

Bench work and machine operations on sub-assemblies are performed in departments parallel to the wing lines and are synchronized to their forward motion through extensive use of long-haul basket and tray conveyors.

Secret of the system's success lies in its radical departure from conventional aircraft shop layout. In detail, it is completely dissimilar from "density production" which Bell engineers believe uneconomic because of time lost in moving staging and tools around each assembly before work is started and removing such equipment after completion of the job.

In Bell's big Buffalo plant devoted to this work the floor space between parallel rows of wing fixture conveyor lines—all moving in the same direction—is as clear as a bowling alley. There are no tool boxes, power line outlets or connections on the floor. There are no dollies or work stands.

When work is above the level an employee standing on the floor can conveniently reach, the fixtures move between permanently elevated walks reached by short flights of steps. So perfectly synchronized is the work that all operations on each wing at that level are performed, regardless of their character, during the time the wing is passing the platform.

Reduced to its simplest terms, the Bell system amounts to moving everything off the work floor and hanging it up in the air where it will not hinder the movement of personnel or of parts.

Receptacles are provided, conveniently suspended from overhead bridging to which drills, rivet guns and all other power-operated tools are attached at working height. This departure has resulted in prolonged life of critical electric cord and tools, and has materially reduced worker fatigue from stooping and bending to the floor for tools.

Just as the carriage trade lost many a fine craftsman to the fledgling auto industry a quarter-century ago, so are the mighty motor manufacturers today losing good men to the fast moving aircraft industry. Bell's pioneering in utilization of conveyor lines can be largely attributed to such a loss.

Behind a yellow oak desk in a typical gray painted shop office in the heart of Bell's wing factory sits genial John "Jock" Rae. A hearty, hard-driving Scotsman, he won his spurs in the production game in some of the largest automobile plants. A master at conveyorizing production, he jumped on the aircraft bandwagon several years ago and one industry's loss was the other's gain. Bell manufacturing executives give Jock much credit for the remarkable speedup in Airacobra production through the use of conveyors.

Would Jock explain the moving wing line system? "Certainly would," he replied with a burr in his voice.

Walking down the production floor between thousand foot long wing lines, we asked him about the history of the system. "There isn't any," he answered. "Same thing we installed in the auto plants years ago."

"You know," he said smiling, "they said it couldn't be done with these airplanes. Well, we were the first that stuck our necks out and tried it."

The plant in which Bell is fabricating wings for this powerful fighting ship was filled with machinery for the manufacture of cast iron radiators three months before the first completed wing was moved through its shipping doors last year.

The bay in which wing final assembly is performed is 100 feet wide and about 1,300 feet long. In paralleling bays all other manufacturing is performed. In the most distant bay, parts are blanked out in the fabricating department. These parts move to the next nearest bay to final assembly and are assembled into small parts. These parts in turn moved forward to the sub-assembly bay, then on to major assembly adjacent to the final line. Small parts which are not added to the structure until it is in the process of final assembly in a conveyorized fixture are carried by overhead conveyor from the distant fabricating department directly to the point on the final assembly lines where they are needed. In the final assembly there are five power lines operated by drag chain. The equipment was built by the Mechanical Handling Systems, Inc., Detroit.

Simple installation

Four of the lines are used for actual fabrication, two for right hand wings and two for left hand wings. The fifth line runs in the opposite direction four times as fast and carries empty fixtures back to the first stations.

The system placed no obstacles on or above the floor level and required little disturbance of the original floor and foundation for installation. Power sources and gears for the chains

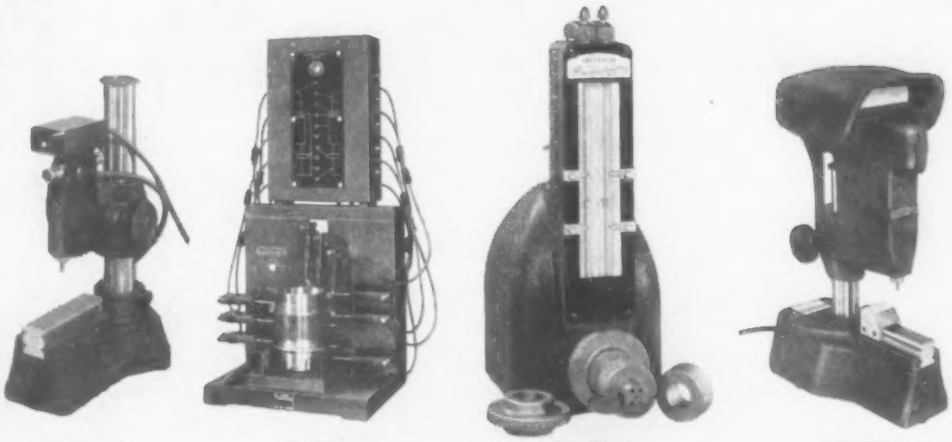
"To err is human" ... and costly!

Inexperience, ineptness, fatigue, ill-health, inattention, indifference—all are possible bugaboos when using fixed gages on extremely close tolerance work (i. e., checking to "tenths").

Scrap, wasted time, production slow-downs, faulty products—these are the high costs of rejecting good parts or passing incorrect parts as being good.

"Hangovers"—physical or mental—make no difference when using a Visual Gage, Multichek, Precisionaire, Electrichek or other Sheffield precision gaging instrument. Mechanical skill built into these gages eliminates the need for "top performance" individual skill to precisely and accurately inspect parts to "tenths".

Sheffield precision gaging equipment eliminates "human" error. Write for new Folder No. 43-1 and name of Sheffield Engineering Representative in your vicinity.



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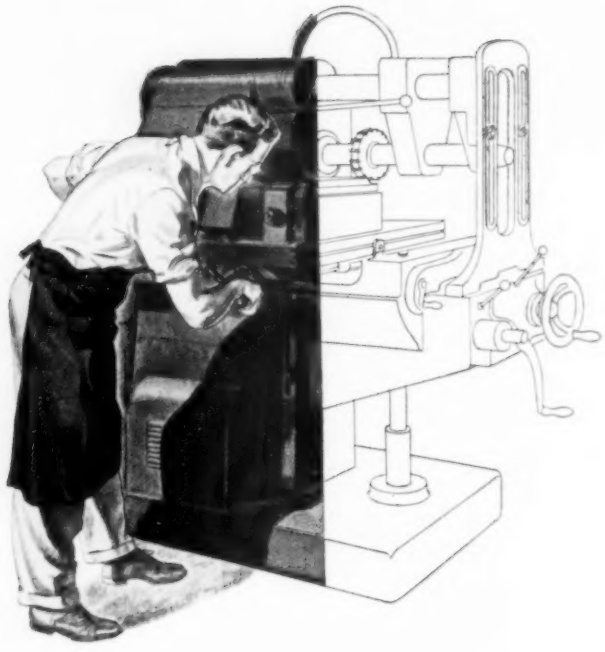

Getting Work Out of the OTHER HALF

This is half a machine. It cost full price, takes up full floor space, uses full operator's time—but it's just half a machine. That's because it is handicapped by a slow setup and removal cycle. It delivers only a part of its potential output.

One of the most important duties of **HECKER** tools, jigs and fixtures is to convert stand-still time into production.

The **HECKER** tool engineer takes account of the worker, the machine and the requirements of the job. Then he designs a tool to bring those three vital factors into the best possible adjustment.

HECKER tools have other purposes, too. It depends on the results wanted. Tools for inexperienced workers; tools to improve quality; tools to speed operating cycles; in short, custom-designed tools, built to the specific problem.

These engineers can see their own designs in daily operation on precision aircraft parts in the **HECKER** plant. That's an extra advantage in firsthand production experience which can help you get more work out of the "other half" of your machines. By way of demonstration, turn a real tooling problem over to **HECKER**—judge for yourself. Write (wire or phone if urgent) to A. W. Hecker, 1988 East 66th Street, Cleveland, Ohio; or, 517 New Center Building, Detroit, Michigan.

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DESIGNERS AND BUILDERS OF TOOLS, JIGS AND FIXTURES . . . FABRICATORS OF AIRCRAFT PARTS

are housed in covered pits at one end of the line. A small covered pit at the other end houses the sprocket for the return loop, which is adjustable to take up slack.

The four production lines travel 25 feet per hour, while the return line travels 100 feet per hour, thus permitting the return of a sufficient number of empty fixtures to keep all four lines filled.

Fixture design

Fixtures in which wings are assembled ride on three small free swiveling wheels. The tail wheel is grooved and rides on an inverted angle iron welded to the base plate beside the chain support. The outer wheels ride on flat plates laid on the cement floor. A locking device at the forward end of the fixture engages the drag chain.

Frame of the fixture is welded iron pipe. The base is formed by an eight inch main beam. This beam is crossed by a smaller pipe at the forward end, forming a "T." The two forward wheels are mounted at the outer ends of this cross bar. Rising vertically from the center of this T-bar is a ladder to support the end plates which position the wing. At the trailing end of the fixture is a shorter tripod of four inch pipe. From the top of this tripod and sloping upward at an angle corresponding to that of the edge of the wing is another four inch pipe. This has a five-inch channel welded to it for support of the two moving elements—the aileron bracket locating fixture and the slot trailing edge holding device. Both can be lifted out when their function is completed.

A woman worker is instructed by a leadman in the operations she performs at her station. Some stations have elevated platforms on which workers stand.

A small fish plate for positioning the outer end of the main wing panel is hinged to the main beam at the bottom and a tongue at the top mates with a groove on the end of the aileron bracket locating fixture with a removable locating pin. When the wing tip is added to the main wing panel, the finish plate is swung out of the way on its hinge.

On the main beam are two padded supporting jacks which help carry the weight of the wing and protect the leading edge from damage during removal from the fixture.

Pads for positioning are precision ground to .0004-inches. This was accomplished by attaching the grinder ways directly to the ladder. As a result, all the pads were ground to the same plane. The center of the pads was relieved, leaving narrow edges to be finish ground. The pads are drilled and tapped to receive the bolts holding the end plates in position.

At each of 40 stations on each assembly line a specific set of operations is performed and the same workers are always assigned to that station.

The return line does more than return empty fixtures. Moving along the wall adjoining the wing sub-assembly department, it makes possible the insertion of the wing's leading edge before each fixture reaches the assembly line.

At each station is a numbered cabinet which contains all the tools, jigs and gauges—correspondingly numbered—which are needed at the station.

On each cabinet is a row of ejectors containing the various sized rivets needed there. The ejectors are equipped with tilt bottoms which release a handful of rivets when struck with the fingers. Each cabinet also has a rack for photographic operation sheets which carry detailed instructions on the sequence of operations at that station.

Final assembly line operations include drilling, riveting and assembly as well as installation of the electrical, hydraulic and fuel systems. As the assembly leaves each station it is stamped OK by inspectors so that final inspection work is maintained at an irreducible minimum.

The return line does more than return empty fixtures. Moving along the wall adjoining the wing sub-assembly department in an adjoining bay, it makes possible the insertion of the wing's leading edge so that its first construction is completed when it reaches Station number one.

Paint booth conveyor

At Station 40 the panels are removed from the moving fixtures and hung on an overhead monorail which carries them to a single drilling machine. At Station 41 a master fish plate drill fixture is bolted to the inboard bulkhead of the wing and all holes are drilled simultaneously on a multiple drill. Bolt holes are reamed to size and the drill fixture is removed.

Then the wing is transferred to an overhead conveyor which carries it through paint booths and final inspection. Like the fixture return line, this conveyor must move four times as fast as the four assembly lines. There is a total of 42 stations in final assembly.

Removed from this line, the wings are transferred to specially designed trailers in which they are transported to Bell's huge new and ultra-modern final assembly plant nearby where they are attached to fuselages on long moving lines.

Thus Bell Aircraft, utilizing virtually every new technique for mass producing a precision product, has conveyorized almost every phase of aircraft manufacture.

THE END

Safety training never ceases in Allis-Chalmers shops. Here is one of the large displays based on the concern's safety manual.

A Workable SAFETY PROGRAM

GEORGE F. NUERNBERGER
HEALTH & SAFETY SUPERVISOR
ALLIS-CHALMERS MANUFACTURING CO.

Here are details on a well-planned safety program that has paid big dividends in one of the nation's largest metal-cutting industries.

TOO OFTEN top management is unaware of the need for a workable safety program until it is brought home by a single tragic accident or an accident rate that has gone sky-high. In most cases, the result is a sudden flurry—posters appear in the shops and other safety measures are taken.

Then, in a week or two, safety is again forgotten.

This is not a workable safety program and at the most it is little more than a gesture toward safety and health. It is not the way the Allis-Chalmers Manufacturing Co.'s program operates.

Our program is a day-to-day affair. There is no great flurry about it; instead, it is a regular, steady educational process. We recognize that you can't teach a person all there is to know about safety in one easy lesson.

Has it produced results? Here are some interesting facts.

In the last six months of 1942, our accident severity rate dropped 52.7 per cent while the frequency rate fell 13 per cent. This is in the face of a vast influx of new and inexperienced employes, many of whom had never been in a manufacturing plant before.

When should an employe's safety training begin? The first day on the job! Under our program, new employes are introduced to safety before they ever get into the shop.

Four hours of the employe's first day are spent in the lecture hall, and the new worker is paid for this time. During these lectures, emphasis is laid on safety without creating fear of machinery. Motion pictures on safe procedures are shown and the use of safety equipment is explained. Furthermore, safety off the job also is stressed.

Co-ordinated with the lectures and motion pictures are the Allis-Chalmers safety manuals. These manuals, which have received national recognition, are not based on the old "Thou shalt not." But the willing and friendly co-operation of the employe is definitely enlisted.

These manuals are attractively illustrated and simply written to encourage readership and study. One of the first manuals exclusively for women was published by Allis-Chalmers. Written from the women's standpoint, it has done more than its share to keep the accident rate down among our rapidly increasing force of women workers.

Publication of a safety manual is not a light undertaking. We devoted much time and energy to research, so that we could tailor the manual to our own needs and problems.

Furthermore, the employe has been taken directly into the safety program by creating safety committeemen in each department. So successful has been this program, that it now is being intensified.

The safety committeeman always works through the foremen and, in event of disagreement between the two over safety methods, the safety committeeman is at liberty to contact a member of the health and safety department who then consults with both the committeeman and the foreman. Monthly meetings are held with the safety committeemen of all departments and common problems are discussed. This is part of a continuing program of education.

Accident-prone employes present a particularly difficult problem. The partially experienced employe is inclined to feel that he "knows it all" as far as safety is concerned. This attitude is an open invitation to an accident. It is the old story of a little knowledge being a dangerous thing.

Accident-prone interviews

To cope with this difficult situation, we have adopted an interview technique. When an employe has had an undue number of mishaps, no matter how trivial, he is given an accident-prone interview. To date, we feel, this method has been successful although our figures are not yet complete in regard to it.

Certainly, we use posters. They are a very effective educational instrument. We use those put out by the National Safety Council in conjunction with those we have developed our-

(Continued on page 108)

Yes WE DELIVER ON TIME

No holding up vital jobs while you wait for your grinding wheels or mounted wheels*.

Timing and scheduling are everything now. That's why our streamlined QUICK SERVICE is such an important asset.

Fully approved and endorsed by W P B, here's our war-time speed setup:

- Manufacture only wheels 3" in diameter and under. To speed production, larger sizes are eliminated for the duration.
- No quitting whistle. We are on the job making wheels 24 hours a day, every day.
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Name .....

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(Continued from page 106)

selves. We also use special safety messages on transfer trucks travelling throughout the shops. Other displays about the shops emphasize various personal protective devices.

Goggle service carts also travel continuously throughout the plant, and thus safety glasses in poor repair are kept in good shape without loss of production time by a trip to the protective equipment headquarters. A display of safety shoes also is circulating continuously throughout the plant. All of these things dovetail neatly into the continuous educational process.

Management, too, must be safety conscious. This is the case at Allis-Chalmers. Control measures were established to insure that all safety equipment is cleared through the health and safety division of the industrial relations department. The various departments responsible for work, material, tools and equipment are cooperating with the health and safety division to see that proper standards are met. All machines and tools are approved, from a safety standpoint, by this division before they are installed.

Management at Allis-Chalmers is convinced that a program along these general lines will pay big dividends in reduced accidents in any manufacturing plant. The general framework of the program is big enough to permit the necessary adjustments for individual plant problems. But once this program is embarked upon, it must be a continuing thing—or it will lose its impetus and be doomed to failure.

THE END

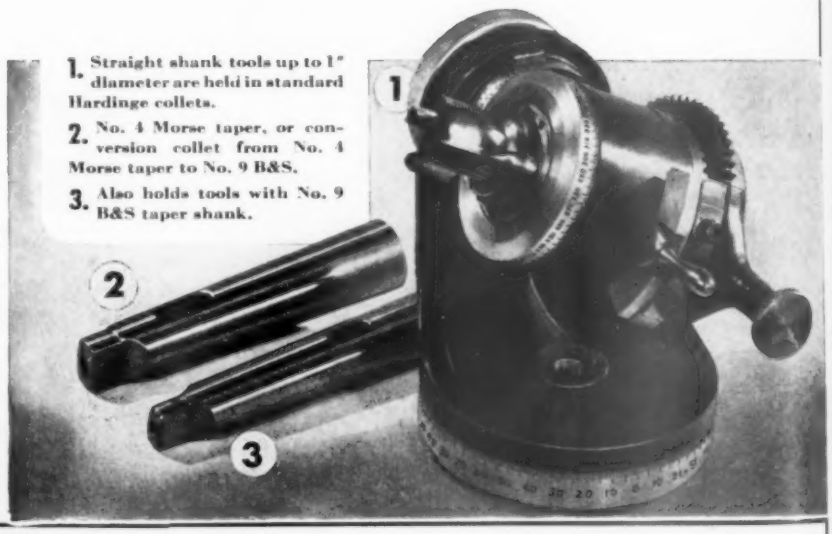
Traveling displays in Allis-Chalmers plants, like this one on safety shoes, is one reason for a reduction of more than 50 per cent in accident severity.

THIS UNIVERSAL PRECISION INDEXING HEAD

can be used on any tool or surface grinder!

It holds all the tools shown at right, and can easily be adapted to hold many others. Graduated 360° in three planes, for every simple or compound angle. Vernier lever will rotate work collet between indexed points without changing index or location of tool in collet. Accurate . . . useful . . . adaptable. Prompt delivery.

Write for illustrated circular.


1. Straight shank tools up to 1" diameter are held in standard Hardinge collets.
2. No. 4 Morse taper, or conversion collet from No. 4 Morse taper to No. 9 B&S.
3. Also holds tools with No. 9 B&S taper shank.
1
2
3

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The TESTMASTER

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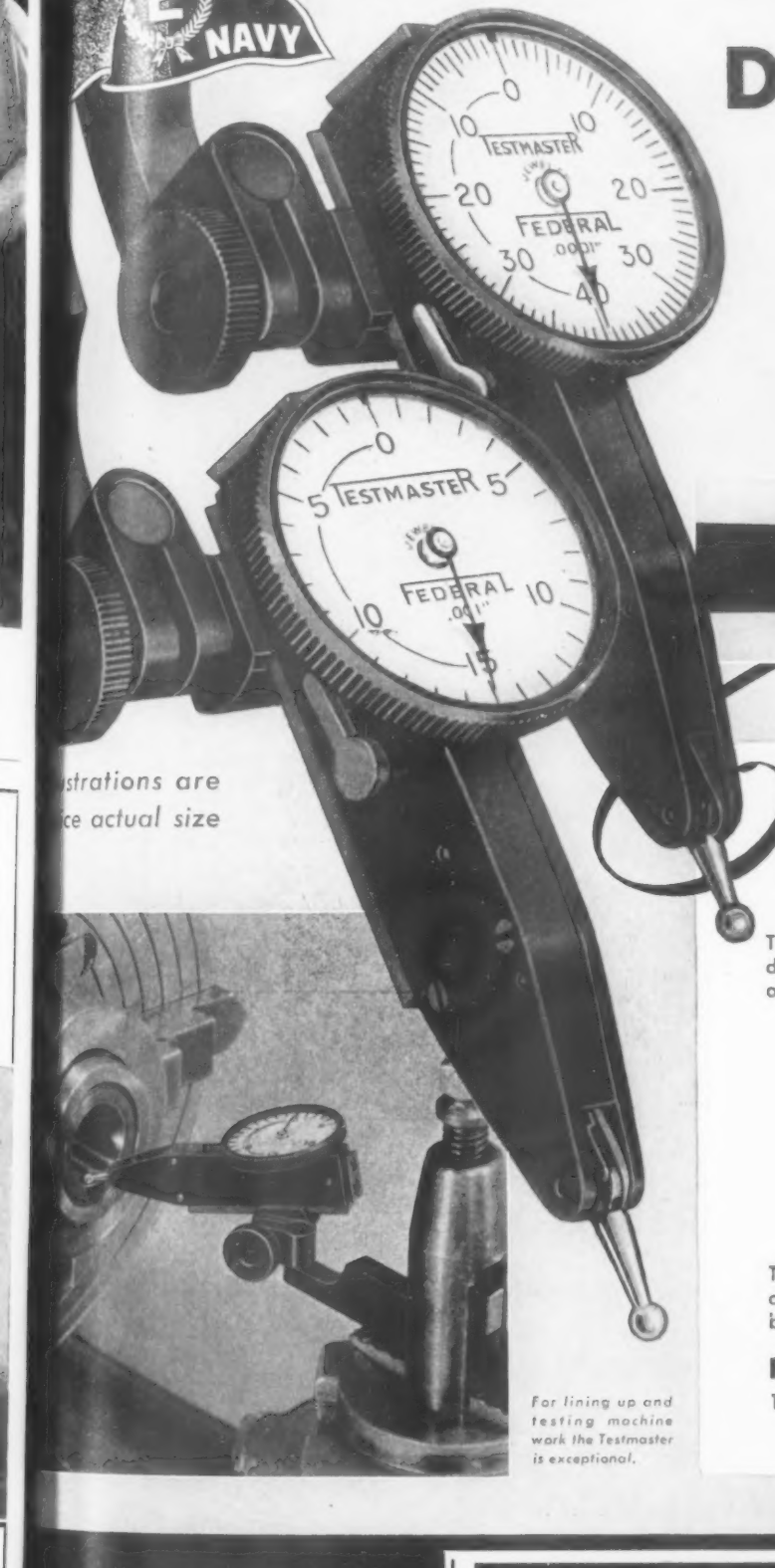

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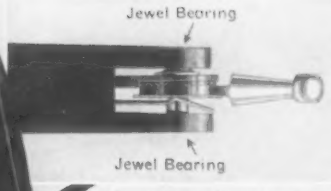
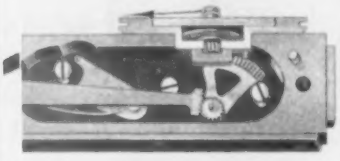


Serrations mesh positively. Interchangeable point locks on pivot. Low friction bearings.



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Fourth — The universal clamp enables setting in any position (other holding bars can be substituted).

Fifth — It has dovetail slides on the bottom edge and back end for more universal setting.

Sixth — Its quality is worth more than the price.

The Testmaster is not sold in stores. Addresses of our offices in the cities below are listed in local telephone books. Or, write us for circular.

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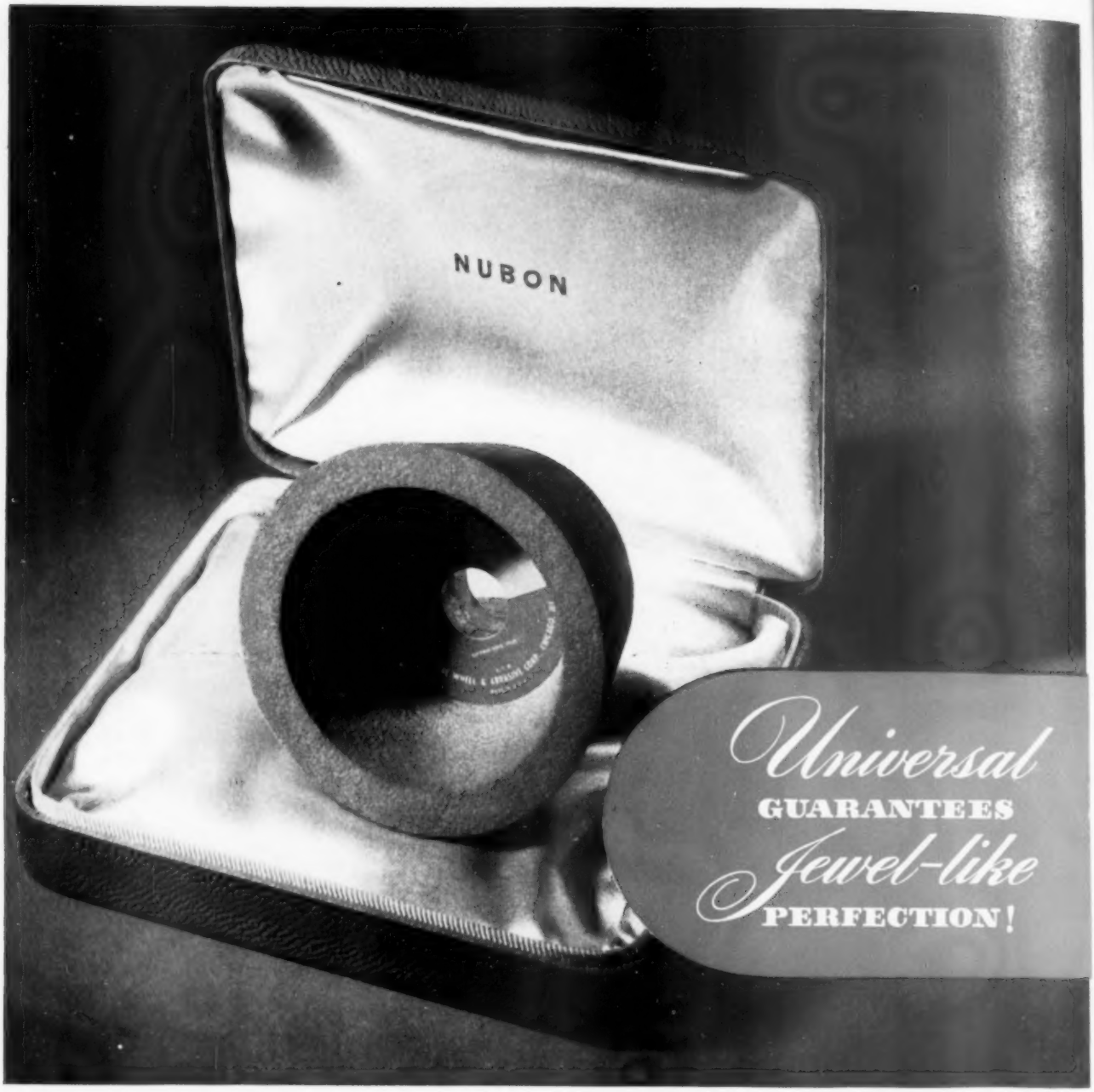

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A.S.T.E. Joins A.S.M.E. in June California Meeting

Three A.S.T.E. Speakers to Present Talks

GATHERING in Los Angeles this month for its semi-annual meeting, the American Society of Mechanical Engineers will present a series of technical sessions designed to speed production for victory.

This West Coast conclave of one of the nation's oldest technical societies will be held for four days, June 14 to 17. In the solution of war production problems, the mechanical engineer is expected to increase the skill and reduce the time required in manufacturing. How he can fulfill these expectations, especially in the field of aviation, will be the subject of talks by a number of outstanding authorities representing leading mass production industries.

By invitation, the American Society of Tool Engineers joins with the Mechanical Engineers in presenting two of the technical sessions scheduled. One of these sessions will be on "Women in Industry"; the other on "Aviation-Production Engineering". In both fields, war-time manpower problems and the design of perishable tools, the A.S.T.E. has displayed leadership.

WILLOW RUN STORY TOLD

Two of the speakers scheduled for the Mechanical Engineers' "Women in Industry" session addressed the Tool Engineers at their Annual Meeting in Milwaukee last March. The first, Wm. A. Simonds, comes from the Ford Willow Run Bomber Plant near Detroit. He will show movies on this industrial gargantua and discuss women workers in the East's largest aircraft factory. The other speaker will be J. I. Onarheim, who will tell how Milwaukee's big Allis-Chalmers Mfg. Co., has trained thousands of women employees.

At the "Aviation-Production Engineering" session, a Tool Engineer speaker will describe tools and methods for high-speed machining of aircraft parts. He is Arthur A. Schwartz, of the Bell Aircraft Corp. Buffalo.

Simonds, associated with Henry Ford for more than 20 years, represents the Public Relations Department of the automobile pioneer's great airplane plant and thus is familiar with operations in every department of the project.

"DON'T BABY WOMEN WORKERS"

On the subject of women workers, he told Tool Engineers that only a small portion of the total number eventually to be employed are working at present. Compared with Great Britain, where 32 per cent of all women are employed in war industry, only four per cent of U. S. women are so engaged, he pointed out the current total of approximately 4,000,000 will be raised to 6,000,000 before the end of the year, he believes.

"A good indication of what lies ahead", he said, "is the experience of 185 major plants in the Detroit area. In these plants, 98.8 per cent of the total recent employment increase has been due to the hiring of women."

Describing the experience of Ford men in placing women in the shop, he said it is most important to start them at the job right. "In general, they require about a week or 10 days more training than men. While they are good on detail work, it is highly important to give them some idea as to where their individual jobs fit into the overall production picture. If they understand this, they are usually happy. If they don't, they frequently quit."

Simonds warned that women should never be "kidded or babied" on the job. "Once you baby a woman worker, she will expect to be babied from then on."

The second Tool Engineer speaker on women in industry will give the Mechanical Engineers facts on the use of womanpower in one of the most diversified industrial concerns in the United States. J. I. Onarheim, Supervisor of Employment for Allis-Chalmers Mfg. Co., told Tool Engineers about the manufacturer's experience in operating several huge metal cutting plants with women workers exclusively.

"The much mooted plan of central nurseries for children of working mothers is greatly over-rated," he said. Experience has taught Allis-Chalmers, Onarheim said, that a woman who has a family to care for usually is a second rate worker regardless of how conscientious she may be or how well her children are cared for while she is at work.

NEW MACHINING TECHNIQUES

Arthur A. Schwartz, who will address the "Aviation-Production Engineering" session in Los Angeles, is Chief Tool Research Engineer of Bell Aircraft. The spectacular new machining processes and equipment he will describe at the meeting may go far in reducing production costs in war work, as well as materially affecting post war metal fabricating in the transportation field. These developments, including one machine that removes metal so fast that it produces 75 gallons of chips per minute, were described by Schwartz in articles which appeared in the April and May issues of The Tool Engineer Magazine.

● J. I. Onarheim will tell how Milwaukee's Allis-Chalmers Mfg. Company has trained thousands of women workers. He described this work to Tool Engineers recently, explaining how to select and direct women.

● High-speed machining of aircraft parts will be the subject presented at the Mechanical Engineers' meeting by A.S.T.E. speaker Arthur A. Schwartz of the Bell Aircraft Corporation.

● William A. Simonds, Ford Willow Run Bomber Plant, speaker at the recent A.S.T.E. Annual Meeting, will discuss the employment of women workers in the automobile pioneer's gargantuous aircraft factory.

Crochet in the TOOL ROOM? of course!

IN suggesting CROCHET in the tool room, we have no thought of converting a busy and important part of your shop into a ladies' recreation center.

On the contrary, many of your tool and die makers and machinists may find this many-purpose "American Swiss" Swiss-Pattern File a help in their precision and accurate filing jobs. The rectangular section with rounded edges of the Crochet file, slightly tapered in thickness and tapered in width from about half the length of cut to a point, permits it to be used on flat and curved surfaces, slots, grooves, narrow spaces, fillets, elongated holes, concave corners, etc., for it is double cut all over.

The Crochet file is but one of more than 40 different shapes in the "American Swiss" line of Swiss-Pattern Files, preferred by experienced tool and die makers and machinists because of their clean, sharp, long-wearing teeth and uniform hardness.

FREE CATALOG
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ASK FOR THEM BY NAME

American Swiss ★ ONLY THE BEST ★

SWISS PATTERN FILES

INGENUITY FOR VICTORY

George D. Roper worker boosts production 500 per cent on shell machining job

AWARDS for contributions of mechanical ingenuity in war production are now legion. All have been deserving, and bulked, have contributed much to the miracle of industrial conversion since Pearl Harbor.

Outstanding among these "ideas" are several developed by Jack Hennessy of the George D. Roper Corp., and winner of a recent Chicago Tribune War Worker's Award. Hennessy received the award for the development of machines and setups for 75 mm. shell manufacture. For this he was cited by Lt. Col. Frank W. Parker, Chicago Ordnance District, in a special radio broadcast.

In a plant converted from gas stove manufacture to the production of projectiles, Hennessy designed and built a special horizontal drill with only one spindle for drilling close-tolerance

Jack Hennessy and drill press set-up.

tracer holes in shells. This machine replaced a vertical four spindle drill press with four fixtures, increased output 500 per cent, and permitted the employment of an unskilled girl on the job. Cost of building the new machine in the shop was $300 compared with $5,000 for a machine of the old type difficult to procure.

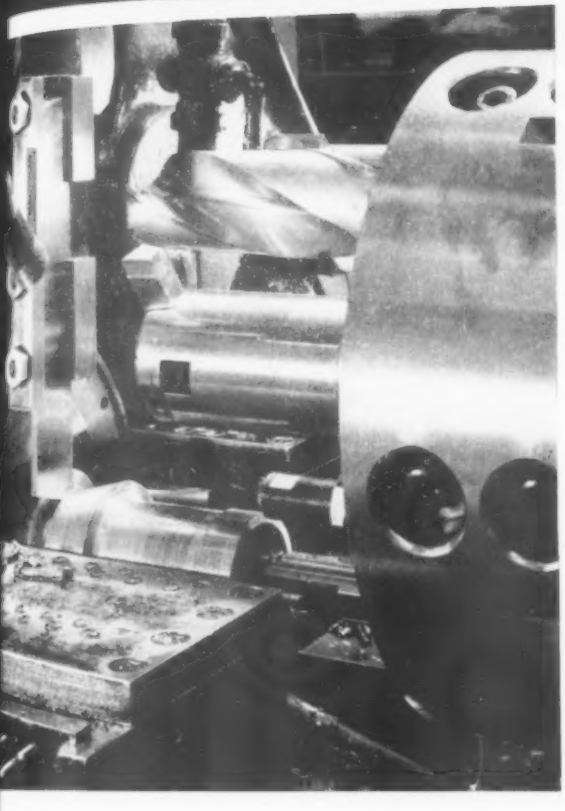
Sequence of operations on the four-spindle drill press were as follows: 1. Inserting the shot in a nest or jig, nose down, in vertical position. 2. Tracer hole drilled. 3. Move shot to next spindle. 4. Tracer hole reamed with form ground reamer. 5. Move shot to next spindle. 6. Countersink tracer hole.

The new setup reduced these operations to one, eliminated the need for three skilled machinists and an inspector.

In addition, he has developed a three-spindle milling machine which mills the crimping notches in the nose of the shot without indexing. The cap is then crimped into these slots to make it an integral part of the shell. The old method called for indexing the shot and milling every slot as a separate operation. Despite the fact that the operation requires the holding of close tolerances, it is performed by an unskilled girl with a 300 per cent increase in output over the old method.

Modest, Jack Hennessy says, "My only hope is that I can do a lot more."

Sets Up Quickly Runs Profitably on CLEVELAND AUTOMATICS with UNIVERSAL CAMMING



THE job shown in work in the photograph at left was processed on a Cleveland *Single Spindle* Automatic. The savings made, in cost and in production time are typical of savings anyone concerned with production wants to make, so give a moment's consideration to this case history . . .

Stock . . . 6½ inch bar, 4160 steel, hot finish.

Operations . . . Gauge, rough drill, rough turn O. D. in two stages, form O. D. complete, rough bore, finish bore, ream and cut off. Finish length 9 1/16 inches. Length of body (formed with one tool) 6½ inches.

This Job Was Set Up Quickly . . . because every operation on a Cleveland Automatic is controlled by standard cams, easily reached and quickly set to any position with the aid of an exclusively Cleveland universal adjustment feature. All control settings are simplified by quick-reading calibrations which reduce original set-up time to a remarkable minimum, also make it possible to retool accurately for a re-run.

Ran Profitably . . . because one Cleveland accomplished what two machines and operators had formerly done, resulting in a saving of more than 62 per cent. This is typical of Cleveland Automatic economies.

That is why, with production men, Clevelands have a reputation for two important advantages . . .

- **1.** Maximum sustained production on long runs, with minimum down time for adjustments . . .
- **2.** Profitable economy on small-lot, short-run jobs.

st Remember.. "CLEVELANDS CUT COSTS"

THE CLEVELAND AUTOMATIC MACHINE COMPANY

CLEVELAND, OHIO

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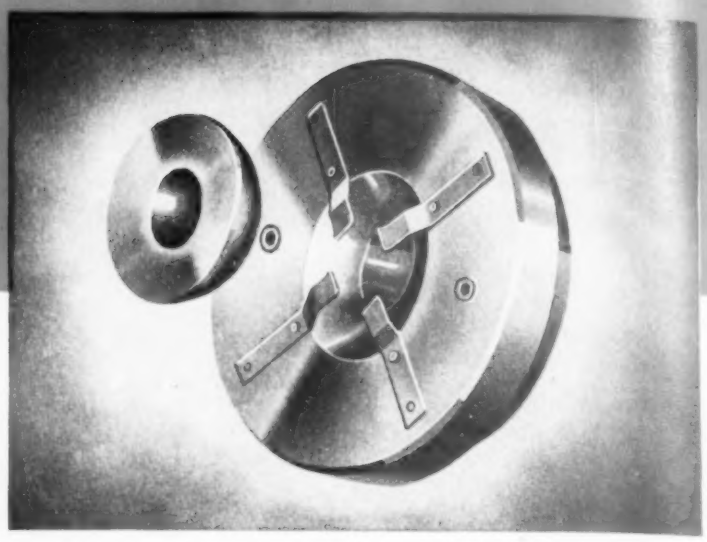
DETROIT: 540 New Center Building ★ ★ ★
NEWARK: 902 American Insurance Bldg.
CINCINNATI: 1315 American Building

TO ASSURE MAXIMUM BROACHING EFFICIENCY

Use a SELF-ALIGNING FACEPLATE



ON ROUGH FORGINGS OR CASTINGS

IF STARTING HOLE IS NOT SQUARE

When cutting a hole with an internal broach it is essential that the starting hole be in perfect alignment with the broach. The surest way to maintain this alignment is to machine the surface which is to rest against the faceplate so that it is square with the starting hole.

Sometimes, however, it is impossible or impractical to make this provision and so a self-aligning faceplate should be used. A faceplate of this type is illustrated above. The hemisphere is held in the socket in the faceplate by spring steel fingers which allow it to move sufficiently to correct any misalignment in the set-up. The cutting pressure of the broach is sufficient to force the part into alignment without undue strain on the broach.

The most common application of a self-aligning faceplate is in broaching rough castings or forgings where there may be considerable variation in the position and condition of the locating face. In fact, this type of set-up should be used wherever there may be doubt about the squareness of the starting hole as the cost is negligible compared to the cost of replacing a broken broach.

COMPLETE BROACH SERVICE

DETROIT BROACH COMPANY

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CAPITAL COMMUNIQUÉ

T.M. REG. U.S. PAT. OFF.

JAY A. BONWIT

Washington Correspondent for
THE TOOL ENGINEER

WAR Production Board announcement that the basic job of tooling had been completed came as no surprise to the machine tool industry. It became apparent six months ago that the back log of orders for tools would soon be diminishing. Stoppage of new facilities construction gave the machine tool builders the first breathing spell since the tooling up process was begun.

This does not mean that the demand for tools is ended. Requirements for the garden variety of tools are filled, but the demand for special purpose tools will continue for the duration of the war. What makes the cutbacks in machine tools so spectacular is the phenomenal rate of production which the industry had achieved.

Nor does it mean that the machine tool builders will be idle. WPB officials maintain that the industry will be converted to production of other war requirements quickly — that there is no question of tool builders shutting down.

Actually, Government studies show a continued high demand for industrial facilities of a certain nature. Some of the new Government plants constructed for the manufacture of bombs and similar items may not be converted when the rate of their output exceeds demand — some plants likely will be closed — but these will be few. Best index of industrial outlook for the rest of this year is the continued shortage of labor, and the fact that demands for steel and non-ferrous metals still exceeds the supply by a substantial tonnage.

* * *

Talk of a return to production of civilian durable goods — gadgets, appliances — is not considered well founded. Between the labor requirements of industry and Selective Service, there will be no manpower to spare for a return to output of non-essentials. It is estimated that between two to 4,000,000 additional women will be drawn into industry to fill the manpower gaps. There will be no excess labor which can be used for a return to peacetime production while the European war continues.

Greater emphasis will be placed on civilian repair and maintenance needs, but this cannot be considered non-essential.

* * *

Conversion of plants from production of one war item to another has been going on for the past five months. Typical among the facilities shifted from one type of production to another are:

Ammunition manufacturers have turned to the production of aircraft engine parts and instruments.

Several gun shops have been converted to make aircraft landing gear.

Tank fabricating facilities have been used for aircraft frame work.

One plant making heavy equipment vitally needed in the aluminum program has been tooled up largely with machinery owned by Army Ordnance.

Army Ordnance reduced its schedule in several plants to furnish labor for an Air Force project going into the same neighborhood.

One plant built to make recoil mechanisms for cannon has been changed over to produce struts for aircraft landing gear.

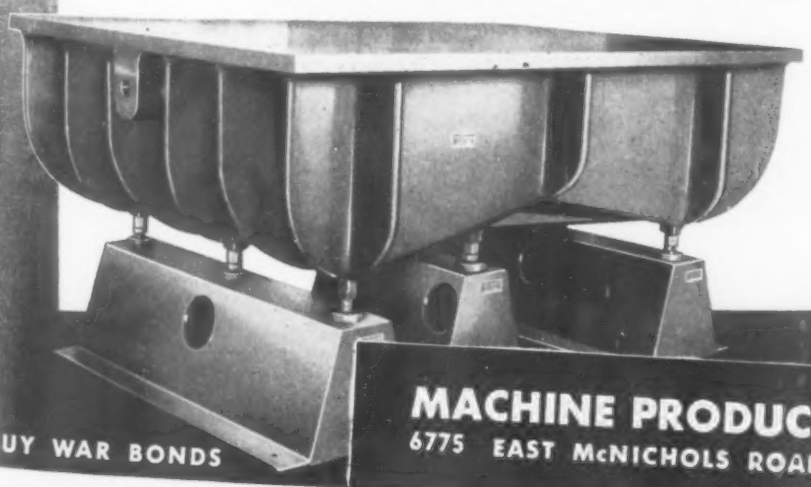
* * *

(Continued on following page)

...and Now

A SURFACE PLATE FOR EXTREMELY HEAVY LOADS

Originally designed and built for a large aircraft motor manufacturer—now available to you. • Surface measures 4 x 6 ft.—depth 20 inches—weighs over 2 tons—the heaviest plate, of these surface dimensions, ever made. Made of Meehanite—recognized for its uniform strength and fine grain structure—meets exacting requirements throughout entire surface. • Mounted on specially designed pedestal type bases—provided with 3 adjustable bearings, supplemented by additional adjusting screws for leveling purposes. • Send for folder showing other sizes and prices.

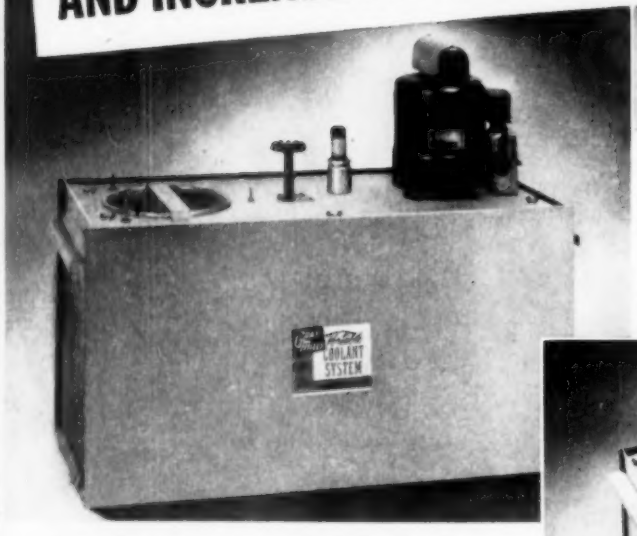


BUY WAR BONDS

MACHINE PRODUCTS CORPORATION
6775 EAST McNICHOLS ROAD • DETROIT, MICHIGAN

Use *coolants* on *all* your machines...

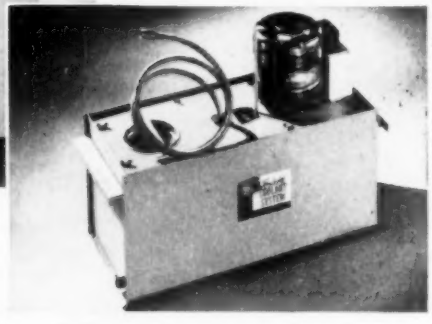
...TO SAVE TIME—TOOLS AND INCREASE PRODUCTION



Above: Standard Model—capacities up to 130 gals. per hour.

Left: Model H-10A Centrifugal — capacities 10 to 1,000 gals. per hour.

Below: Heavy Duty "A" Series Model—capacities up to 165 gals. per hour.

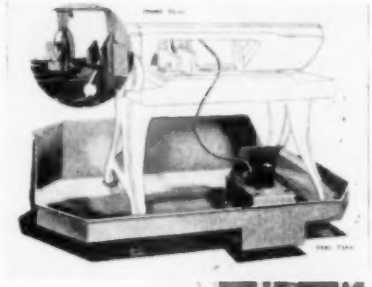


GRAY-MILLS *Portable* COOLANT SYSTEMS

HERE is the simple, economical way to equip your machines to use coolants —to help them produce more and better work—faster! Gray-Mills Systems have increased the efficiency of hundreds of machines on operations like drilling, milling, sawing, grinding, honing, tapping, threading and cutting. They are quickly and easily set up to operate either as a permanent or temporary part of a tool. Sturdily built Gray-Mills Systems are available in both gear and centrifugal types with capacities from 50 to 1,000-gals. per hour—controlled flow. Prices range from $39.50 to $189.50.

• If you want to modernize your older machines — equip small, large or special tools for greater efficiency — or have a "standby" and "clean out" system there is a Gray-Mills for the job. Call your distributor or write direct.

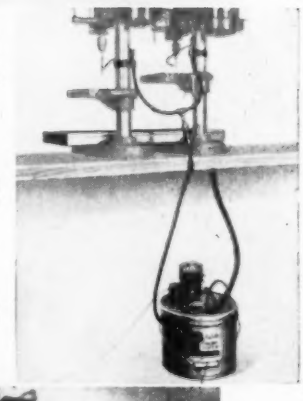
GRAY-MILLS CO., 235 W. Ontario St., Chicago



Above: Model S-20 system for horizontal band saws.

Right: Standard model serving 2 drill presses.

Below: "A" series model on a bench lathe.



Send for this new catalog — it gives full details.

PROMPT SHIPMENTS

Use FLO-BAC COOLANTS . . .

. . . 5 types for most requirements — 10 and 55-gal. containers — immediate delivery from your distributor or our plant.

GRAY-MILLS

Complete Portable COOLANT SYSTEMS

Capacities 50 to 1000 G.P.H. Pressures 8 to 150 lbs.

(Continued from preceding page)

Priorities on the use of [illegible] facilities have been established by WPB in an amendment to Priorities Regulation No. 1. This action is designed to permit a prime contractor to assure delivery by a subcontractor whose machine time on a bottleneck operation is involved.

As a matter of policy, it is contemplated that the ratings will be assigned only for the following three types of contracts for the time being:

1. Contracts entered into by an individual producer or manufacturer calling for fabrication or processing of material or products. Facilities preference ratings will not be applicable to contracts for processing material for an ultimate consumer.

2. Contracts calling for the use of equipment in essential construction work not requiring the delivery of materials. Such construction equipment would include excavating, concrete mixing, and dredging machinery.

3. Contracts for the use of substantial facilities needed in the maintenance or repair of machinery, plant or equipment of essential producers or manufacturers (except contracts for ordinary plumbing, heating, electrical or automotive repairs).

Shortages of facilities commonly used in connection with such transactions have developed as a result of war production demands. WPB frequently receives requests for preference ratings to cover the use of machine tools.

This unbalanced situation has been making it more difficult to have necessary processing and fabricating completed to meet required major delivery dates.

* * *

Recent actions of significance to the metal cutting industry were as follows:

April 19 — WPB Conservation Division recommended adoption of a company-wide tool care policy in all war production plants. It was pointed out that a large tonnage of critical alloys can be saved by increased emphasis on tool conservation.

April 22 — Order M-21-h (tool steel) was amended by WPB to provide a reasonable flexibility in the requirement that a certain percentage of all high-speed steel orders be of molybdenum types.

April 22 — General Limitation Order L-221 was amended providing a number of changes in provisions controlling production and delivery of electric motors and generators.

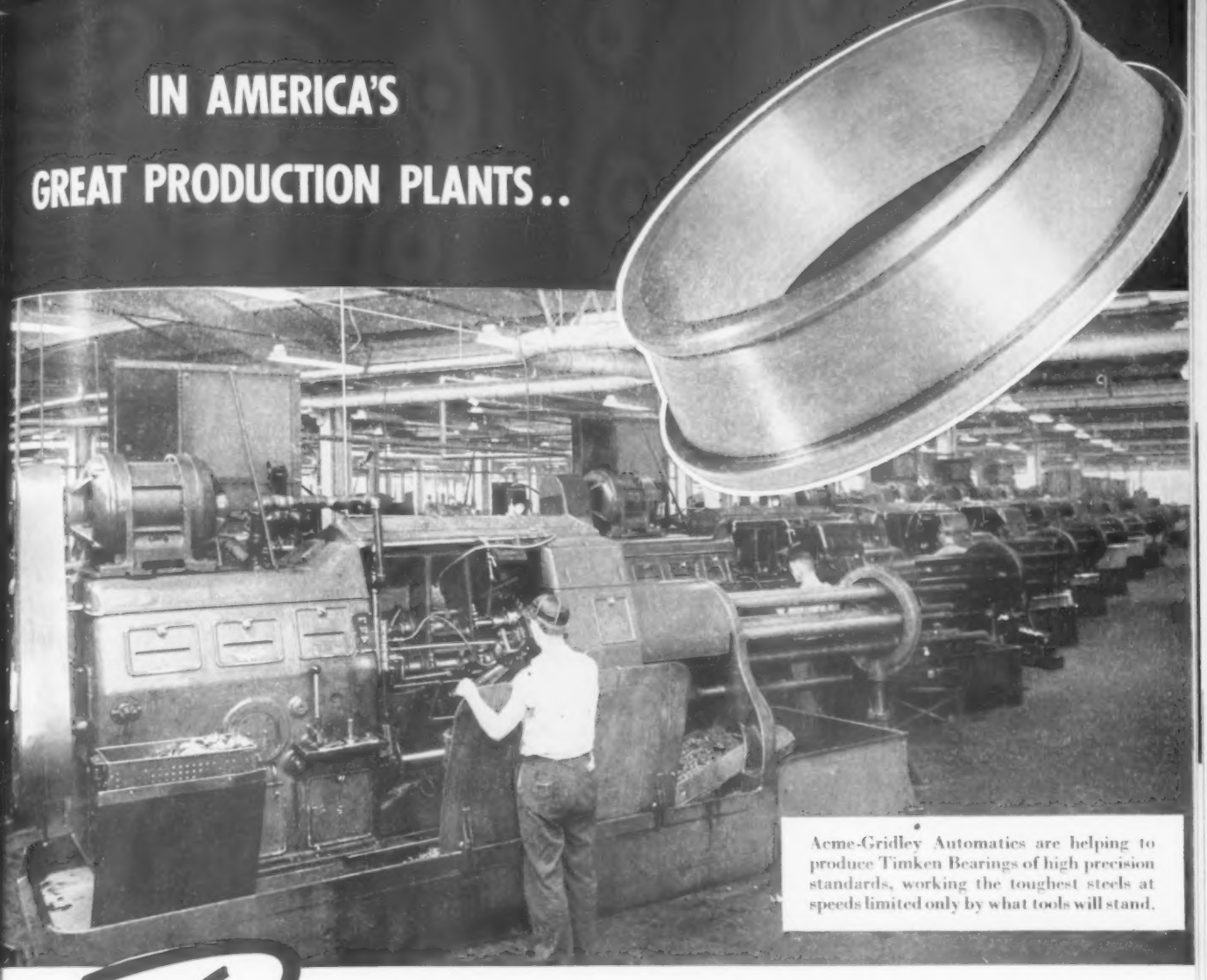
April 22 — WPB issued a direction pursuant to Order M-19-a, instructing producers of ferrochromium to use a specific portion of low-grade ores. In production of high-carbon ferrochromium, producers are required to use chrome ores having a weighted chromium-to-iron ratio not exceeding 2.6 to 1. This restriction is expected to result in production of a high-carbon ferrochrome containing about 65 percent chromium.

April 23 — General Preference Order E-11 issued by WPB controlling production and sale of foundry equipment and electric metal melting furnaces.

April 23 — Direction 5 under CMP Regulation No. 1 issued, preventing steel producers from shipping, until further notice, normalized or heat-treated carbon or alloy steels on any commercial warehouse order.

(Concluded on page 118)

IN AMERICA'S GREAT PRODUCTION PLANTS..



Acme-Gridley Automatics are helping to produce Timken Bearings of high precision standards, working the toughest steels at speeds limited only by what tools will stand.

Precision- plus SPEED!

Helping other manufacturers make things better, cheaper, quicker than they have ever been made before—that's our business.

The bearing races made by Timken, on Acme-Gridley Automatics, are uniformly accurate and machined to tolerances that are new to mass production methods. For example, the 7″ diameter bearing part shown above is machined from tubing in 1/10th the time formerly required by single spindle methods.

This speed in precision manufacture is certain to be an important factor in turning out better postwar products, at costs that will challenge competition.

THE NATIONAL ACME CO.

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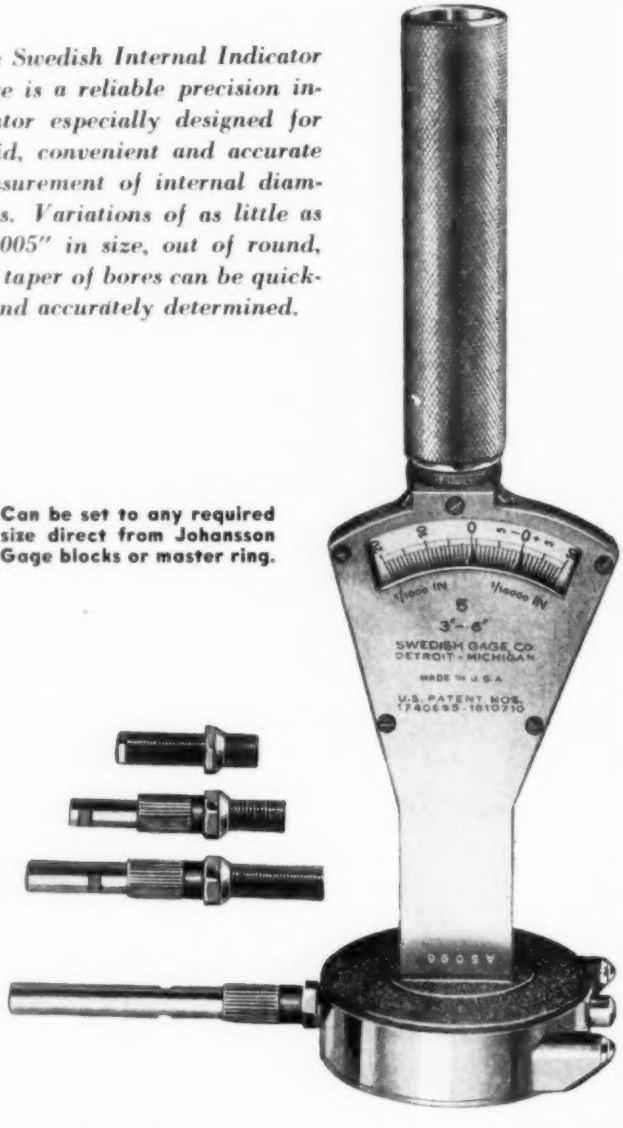
ACME-GRIDLEY 4-6 AND 8 SPINDLE BAR AND CHUCKING AUTOMATICS • SINGLE SPINDLE AUTOMATICS • AUTOMATIC THREADING DIES AND TAPS • SCREW MACHINE PRODUCTS • THE CHRONOLOG • LIMIT SWITCHES • POSITIVE CENTRIFUGE • CONTRACT MANUFACTURING

INTERNAL INDICATOR GAGE

The Swedish Internal Indicator Gage is a reliable precision indicator especially designed for rapid, convenient and accurate measurement of internal diameters. Variations of as little as 0.00005" in size, out of round, and taper of bores can be quickly and accurately determined.

Can be set to any required size direct from Johansson Gage blocks or master ring.



It is a light, easily handled instrument suitable for use on internal grinding, diamond boring or honing machines; or wherever a reliable method of accurately determining bore diameters is required; giving the operator positive control over the size and shape of bore. The use of this gage by machine operators, as well as for final inspection, increases production, reduces scrap, and produces a more uniform product.

The scale range is: Plus or minus 0.001" graduated to 0.0001" and minus 0.020" graduated to 0.001".

The plus or minus 0.001" range graduated to 0.0001" is used for checking the finished part. Scale divisions have ample width and variations of 0.00005" can be easily detected.

SWEDISH GAGE COMPANY of AMERICA

8900 ALPINE AVE. **DETROIT, MICHIGAN**

(Concluded from page 116)

April 28 — Order E-6 amended to provide that production and delivery schedules of hand service tools may be modified by the WPB.

April 28 — WPB urged industrial supply distributors to aid in redistribution of tools immobilized in industrial plants. A task commiitee was formed to consider the problem of redistribution of cutting tools and precision tools lying idle in plants.

May 1 — All iridium supplies were placed under allocation with issuance of Conservation Order M-49 as amended. Use is limited to contact points, fuse wire for detonators, electrical primers and laboratory ware, with such use subject to special WPB authorization.

May 4 — Conservation Order M-146, covering quartz crystals was amended, the changes relating almost entirely to definitions of materials.

May 4 — Steel Division of WPB announced that special measures are being taken to regulate production of high quality carbon steel because of the increased demand to meet war requirements. It was pointed out that every effort is being made to urge buyers to use regular carbon steel in place of the quality grades wherever it is practical to do so.

May 4 — WPB slightly modified provisions controlling production and distribution of certain light power-driven tools in an amended version of Limitation Order L-237.

May 5 — Tool steel scrap was removed from price control under GMPR and specific dollars- and-cents ceiling prices were established for five types of segregated scrap in a maximum price regulation for tool steel scrap issued by the OPA to facilitate recovery of alloy steel scrap containing tungsten, molybdenum and cobalt.

May 7 — In an attempt to simplify administration of Chromium Order M-18-a, Supplementary Order M-18-a-1 was issued permitting small deliveries of chromium without WPB authorization.

May 11 — WPB issued Order M-21-h, as amended, authorizing purchase and production of a greater amount of tungsten high-speed steel than previously permitted. This is designed to accomplish necessary savings in current use of molybdenum. Tungsten-type high-speed steels may be produced and purchased up to 35 percent of the production of the total high-speed steel, as opposed to the former limitation of 25 percent.

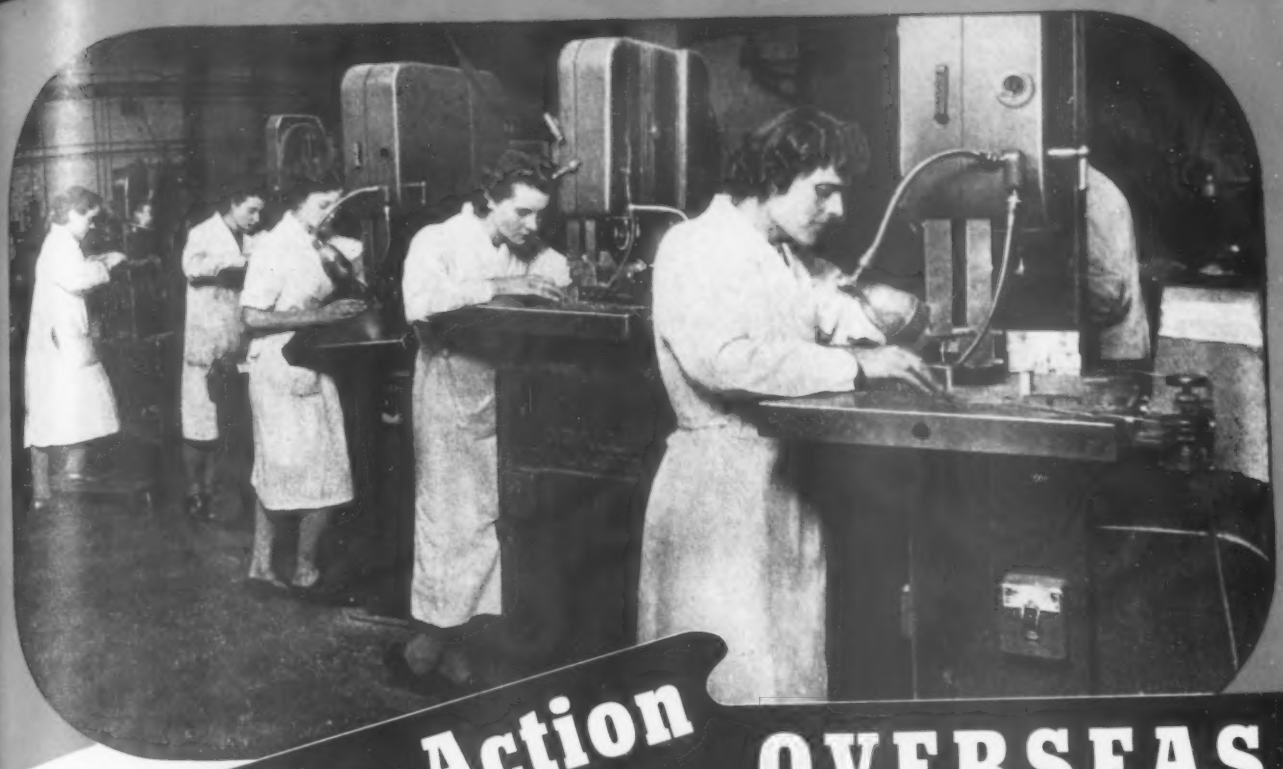
May 15 — Direction No. 1 to CMP Regulation No. 5 sets up procedure for purchase of aluminum patterns under the CMP. Patterns are defined as including only match plates, patterns, core boxes, core driers and snap flasks — and not jigs, fixtures or forming blocks.

May 17 — Priorities Regulation No. 1 was amended by providing that use of facilities is subject to the preference rating sytem.

May 17 — Priorities assistance is provided for certain manufacturers who do not obtain production materials under CMP regulations, under terms of Priorities Regulation No. 11B.

May 18 — WPB announced termination on June 30, 1943, of use of allotment numbers as an up-rating device for obtaining non-controlled materials.

THE END.



DOALL in Action OVERSEAS

2nd January, 1943

Messrs. Continental Machines, Inc.
Minneapolis, Minn.

Gentlemen:

We are sending you a photograph showing a batch of DoAlls operated by girls.

Our experience over the last 5 years is quite interesting. Prior to the outbreak of the war, the saving effected on the DoAlls represented a difference between *Loss* and *Profit* when meeting competitors' prices for Gauges, Form Tools and Press Tools. Today, of course, the saving in time is much more important.

It is not an uncommon thing for us to produce a very intricate Form Tool at 24 hours' notice, and thus remove bottlenecks which, under normal circumstances, would take several weeks of highly skilled labour to overcome the difficulty when using what would be termed orthodox machines and methods.

Yours sincerely,

PRECISION WORKS,
Surrey

NEW HANDBOOK— 250 pages of pictures and data about the Art of Contour Machining, with many ways to save man hours and material in metal working plants. Ask for copy.

DoAll Owners— If you have not seen the DoAll Attachment folder, send for copy today. It illustrates equipment for holding and guiding work, mitering, cutting discs, etc.

CONTINENTAL MACHINES, INC.
1301 S. Washington Avenue Minneapolis, Minn.

DoAll Offices in 25 cities, each in charge of a trained sales engineer to give you quick service on Contour Machines, DoAll Band Saws and Files, DoAll Gage Blocks and Surface Grinders.

COMPLETE ANALYSIS

OF PRODUCTION REQUIREMENTS

By CINCINNATI Service Engineers

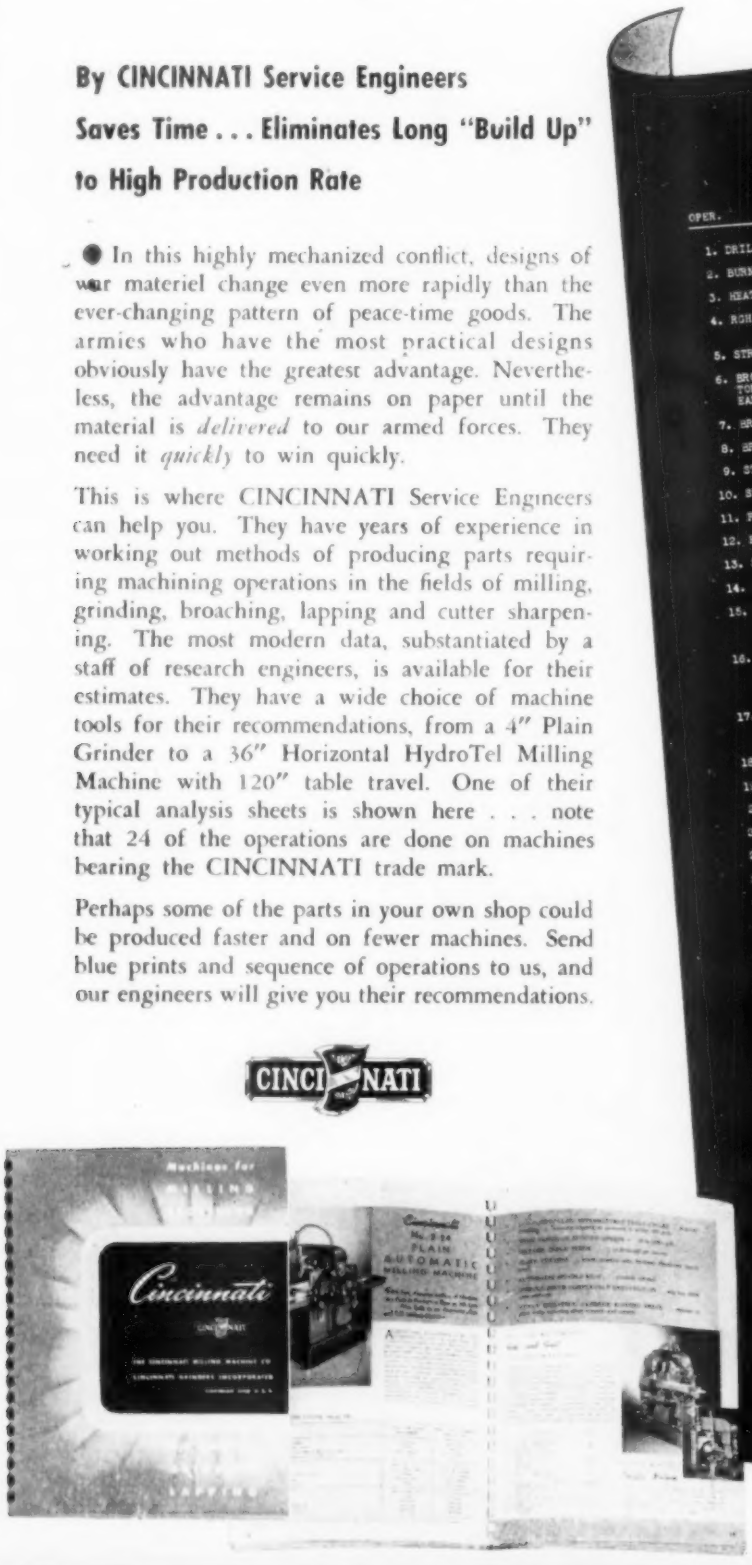
Saves Time . . . Eliminates Long "Build Up" to High Production Rate

● In this highly mechanized conflict, designs of war materiel change even more rapidly than the ever-changing pattern of peace-time goods. The armies who have the most practical designs obviously have the greatest advantage. Nevertheless, the advantage remains on paper until the material is *delivered* to our armed forces. They need it *quickly* to win quickly.

This is where CINCINNATI Service Engineers can help you. They have years of experience in working out methods of producing parts requiring machining operations in the fields of milling, grinding, broaching, lapping and cutter sharpening. The most modern data, substantiated by a staff of research engineers, is available for their estimates. They have a wide choice of machine tools for their recommendations, from a 4″ Plain Grinder to a 36″ Horizontal HydroTel Milling Machine with 120″ table travel. One of their typical analysis sheets is shown here . . . note that 24 of the operations are done on machines bearing the CINCINNATI trade mark.

Perhaps some of the parts in your own shop could be produced faster and on fewer machines. Send blue prints and sequence of operations to us, and our engineers will give you their recommendations.

CINCINNATI


PART NAME [redacted]
REQUIRED PRODUCTION - [redacted] PER HOUR
OPER. NAME
PRODUCTION NOT COUNTING SET-UP
SKETCH
OUR ORDER NUMBER
MACHINE
1. DRILL TWO 13/16 HOLES
2. BURN OUT
3. HEAT TREAT & BRINNELL
4. RGH SLOT TO .845 TO 7.487 .851 TO 7.493
5. STRADDLE MILL SIDES & BOTTOM
6. BROACH 1 SIDE BETWEEN EARS TOP OF TRUNION & 1 SIDE OF EARS
7. BROACH TOPS OF EARS
8. BROACH OPPOSITE SIDE-SAME CUT
9. STRADDLE BROACH EARS-1ST. CUT
10. STRADDLE BROACH EARS-2ND. CUT
11. FORM BROACH ENDS 1ST CUT
12. FORM BROACH ENDS 2ND CUT
13. STRADDLE BROACH EARS 3RD CUT
14. BROACH BETWEEN TRUNIONS & EARS
15. BROACH 1ST. CUT BETWEEN EARS & TOP STEP 3 DEG. & 6 DEG. ANGLE 1 END.
16. BROACH 2ND CUT BETWEEN EARS, LOWER STEP 3 DEG. & 6 DEG. ONE END, AND 3 DEG. ANGLE OPPOSITE END.
17. DRILL FOUR .393 HOLES, ONE 7/16" HOLE AND HOLLOW MILL TRUNIONS
18. PROFILE CONTOUR OF EARS
19. MILL BEARING PADS
20. MILL 75 DEG. & 7 DEG. ANG. CUT
21. MILL .394 X .079 SLOT IN EARS
22. MILL .878 X .433 DIM.
23. MILL .394 X .059 SLOT IN EA. SIDE
24. MILL 30 DEG. CUTS X .256 DIM.
25. PROFILE .472 ELONGATED HOLE IN RIGHT END
26. FINISH PROFILE 1.004 TO WITHIN .197 OF BOTTOM
27. PROFILE 1.496 AND .984 DIM.
28. PROFILE .118 CUTS
29. PROFILE 1.004 AT BOTTOM
30. DRILL .502 RAD. IN RIGHT END
31. REAM .492 RAD AND 1 DEG. 26' ANGLE
32. FORM CUT RADIUS NEAR TRUNION
33. POLISH EDGES ALL OVER
34. FILE WHERE NECESSARY
35. PARKERIZE
PRINT E
2 ABREAST
(B-1854-B) 41B-343307
(B-1854-A) 41B-343307
(B-1854-C) 41B-343307
(B-1854-D) 41B-343307
(B-1854-D) 41B-343307
(B-1854-E) 41B-343307
(B-1854-E) 41B-343307
(B-1854-D) 41B-343307
(B-1854-F) 41B-343307
(B-1854-G) 41B-343307
15# PER MACHINE
25
33 PER MACHINE
TWO NO. 10-66 DUPLEX BROACH
87
52 PER MACH.
40 PER MACH.
52
30 PER MACH.
40
15 PER MACH.
31
40
PRINT C 41M-340187
PRINT B 41M-344256
PRINT ? 41M-344257
RECIPROCATE -------
PRINT A 41M-344256
RECIPROCATE -------
BOX MILL 41M-332589
BOX MILL -------
BOX MILL -------

Left: General Catalog, No. M-995-1. Contains illustrations and condensed information on complete line of CINCINNATI Milling, Grinding, Broaching, Lapping and Cutter Sharpening Machines

TOOL ROOM AND MANUFACTURING MILLING MACHINES . . . SURFACE BROACHING MACHINES . . . CUTTER SHARPENING MACHINES

Industrial News Digest....

A review of significant developments and new techniques in mass production industries.

Aircraft producers pool ideas; Post war developments hinted

Representatives of 16 aircraft factories scattered from coast to coast and accounting for 90 per cent of the nation's war plane production, have organized the National Aircraft Production Council to pool production ideas and equipment.

Its Work: The Council will link manufacturers, government and armed forces. It was organized through merger of the Aircraft War Production Council, Inc., representing eight western concerns, and the Aircraft War Production Council, East Coast, Inc., comprising eight eastern firms. Its office is in Washington.

Participating firms are: Aviation Corp., Bell Aircraft, Brewster, Curtiss-Wright, Eastern Aircraft Division of General Motors, Fairchild, Martin, Republic, Boeing, Consolidated-Vultee, Douglas, Lockheed-Vega, North-American, Northrop, and Ryan.

* *

Vega: Though tooling for much of the war production job may be completed, it is far from finished in the aircraft industry. Lockheed Aircraft and its subsidiary, Vega, have a big job on their hands preparing for manufacture of the huge Constellation transport. Said E. E. Gross, firm president recently, "We are now tooling —for its production. We expect to deliver some Constellations this year, and next year will see it really rolling." He added that Lockheed is rebuilding its production lines for greater production of the P.38 twin-engined fighter.

Goodyear: Another notable chapter in the story of America's war production effort was written in Akron, Ohio, recently when the first Vought Corsair fighter was completed by the Goodyear Tire & Rubber Co.

The rubber concern has had 30 years aeronautical experience. Pooling their knowledge and experience, Chance-Vought and Goodyear designed the long mass production lines and tools now spewing forth these 400-mile-per-hour fighters.

* *

New Division: G. W. Vaughn, president of Curtiss-Wright Corp., has announced the formation of a new division of that organization to be known as the Development Division.

Peter F. Rossman, chief of Development Research in the Airplanes Division Research Laboratory of the Corporation, has been appointed general manager of the new Division, which will be located in New Jersey.

Purpose: The new unit marks the fourth division of the Corporation, and will provide a means of implementing collaboration on engineering problems relating to the other three divisions of the Corporation in their all-out production of warplanes, engines and propellers for war and will anticipate the development of post-war products and markets.

Significant is the revelation that the engineering staff being organized will include technicians and engineers who are expert in both aeronautical and non-aeronautical fields.

Unusual deep drawing job performed on huge press

Formed on a drawing press, described as the world's largest, at the plant of Weber Showcase and Fixture Co., Los Angeles, more than 300 auxiliary gasoline tanks which greatly increase the range of the Army P-38 fighter plane are produced every 24 hours.

Each plane, on long range flights, carries two tanks under the wing. The tanks, 10-feet long and 27-inches in diameter, may be dropped when empty. So clean is the aerodynamic design that, when filled with 165 gallons of gas each, two of them reduce the plane's top speed only four per cent.

Welded job: The press which stamps each half of the tank in a single down stroke, forms it from sheets of extra deep drawing steel. Later the halves are welded together at a Lockheed plant.

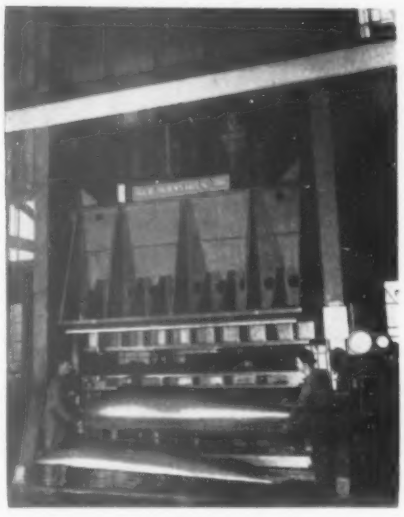
The press was built by Weber at a cost of $100,000 to turn out Liberty ship cowl ventilators (See The Tool Engineer, October 1942). Today, the press alternates in its duties, stamping both the ventilators and gas tanks.

Only two main steps are involved in producing the tank halves. After the sheets of 24-gauge deep drawing steel, which measures 48 by 144 inches, and weighs 41 pounds when completed, are properly hand-trimmed, they are inserted one-by-one into the press. Following this operation, the halves are passed to a newly designed automatic, hydraulic machine which prepares them for welding.

When attempting to draw the steel into the gas-tank shapes, however, pressures originally available from eight air cushion pads were not adequate to draw the metal free from wrinkles. Consequently, 10 additional

(Continued on following page)

An Unusual Stamping Job



At a rate exceeding 600 per day, steel halves for droppable gas tanks for aircraft are produced in this big deep draw press by the Weber Showcase & Fixture Co., Los Angeles. The halves are later welded together by Lockheed.

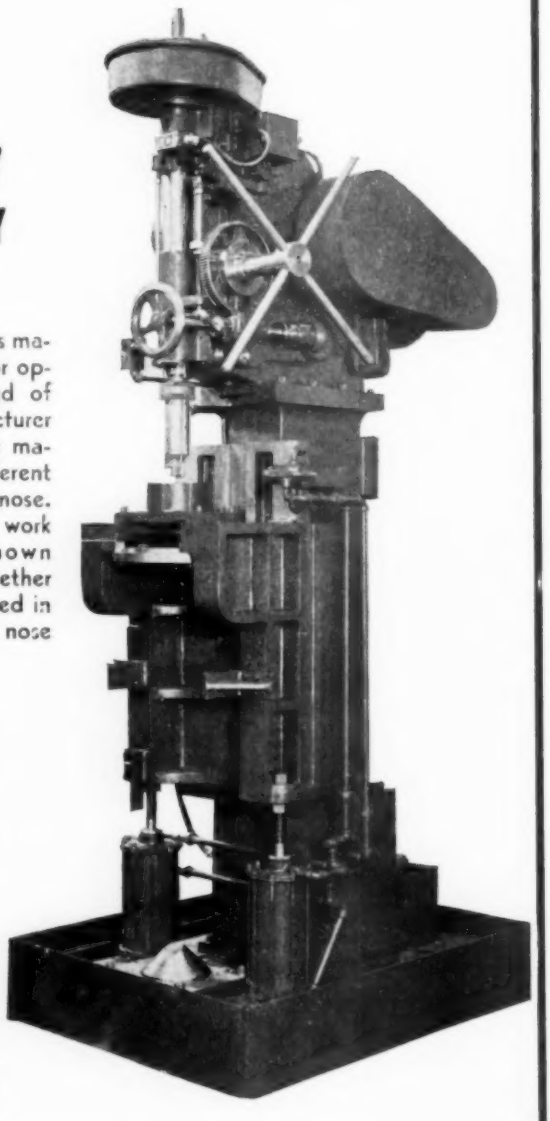
"GREENIE" T.M. REG. U.S. PAT. OFF. — *A Budding Machinist*

GREENIE—CHASE OVER TO THE CRIB AND GET A SET OF SKY-HOOKS AND A BUCKET FULL OF STEAM!
QUIT KIDDING, BOSS—I'VE HEARD THOSE OLD GAGS BEFORE! TELL ME—SHOULD I USE A STUB ARBOR AND LIVE CENTER TAIL STOCK WITH TANG DRIVEN FIXTURE TO ROUGH AND FINISH-TURN THIS JOB?
THE GALS ARE GETTING SMARTER EVERY DAY—WE BETTER WATCH OUT OR THEY'LL TAKE OVER OUR JOBS AFTER THE WAR!
RALPH DAVIS

Get FLEXIBILITY FOR WAR WORK With BAKER MACHINES!

MODEL 217 HEAVY DUTY DRILL

The illustration shows this machine specially tooled for operation in the nose end of bombs. One manufacturer uses a battery of these machines to perform 4 different operations in the bomb nose. On this machine the work holding fixture is shown mounted in place, together with the cutting tools used in boring and facing the nose end.



Write for Complete Information

ARMY E NAVY

AWARDED FOR EXCELLENCE IN WAR PRODUCTION MARCH 20, 1943

Operations handled on this machine include: 1. Drill from the solid. 2. Rough coredrill and rough face. 3. Finish ream and face. 4. Tap. These operations are handled on individual machines, rechucking for each operation. This mechanical feed machine is arranged with holding fixture and increased clearance to accommodate 500 pound bombs. With extra adapters, the machine can also handle 1000 pound bombs.

BAKER BROTHERS, INC.

TOLEDO **OHIO**

(Continued from preceding page)

air cushions of 7.5-inch diameters were built. These added 60 tons pressure on the drawing ring, resulting in the elimination of wrinkles from the sheets. These cushions make the use of shims unnecessary.

Largely responsible for smooth drawing, Weber engineers state is the 10-ton Meehanite iron die. This die replaces a Kirksite die formerly used.

Speed of the down stroke, providing pressure of 500 tons on the tank halves, may be varied at will. Whereas the rams which bring the platen down have a stroke of 84 inches, only a 30-inch stroke is required to shape the tanks.

After the halves come from the press, the outside flange is trimmed by hand and the half then is inserted into the hydraulic press, which punches all locating holes, as well as holes which will receive vents, filler plugs and other connections. This is accomplished in a single operation as follows:

While the top holds the tank in place, two hydraulic cylinders come down vertically, punching holes around the outside edge from a spring pressure pad, actuated by the terminating stroke of the cylinders. These cylinders are held in the down position while the operator cuts in a lever which operates three smaller hydraulic cylinders, which in turn operate the dies to punch the holes required. These items are all compound, performing both operations in a single stroke. Employment of this machine saves approximately two hours in the preparation of each tank.

Firth-Sterling Announces "War Discount"

Described as a contribution to the war effort and combating inflation, Firth-Sterling Steel Co., has instituted what it believes is a new type of discount.

One year: Based on the rapid increase in the use of Firthite Sintered Carbides, this discount of 10 per cent is effective for the balance of this year. It applies to Firthite in all forms, including tips and blanks, milled-and-brazed tools, general purpose tools, standard tools, and special tools. The discount is effective on all unfilled orders.

Greater war effort must be put forth says ASME president

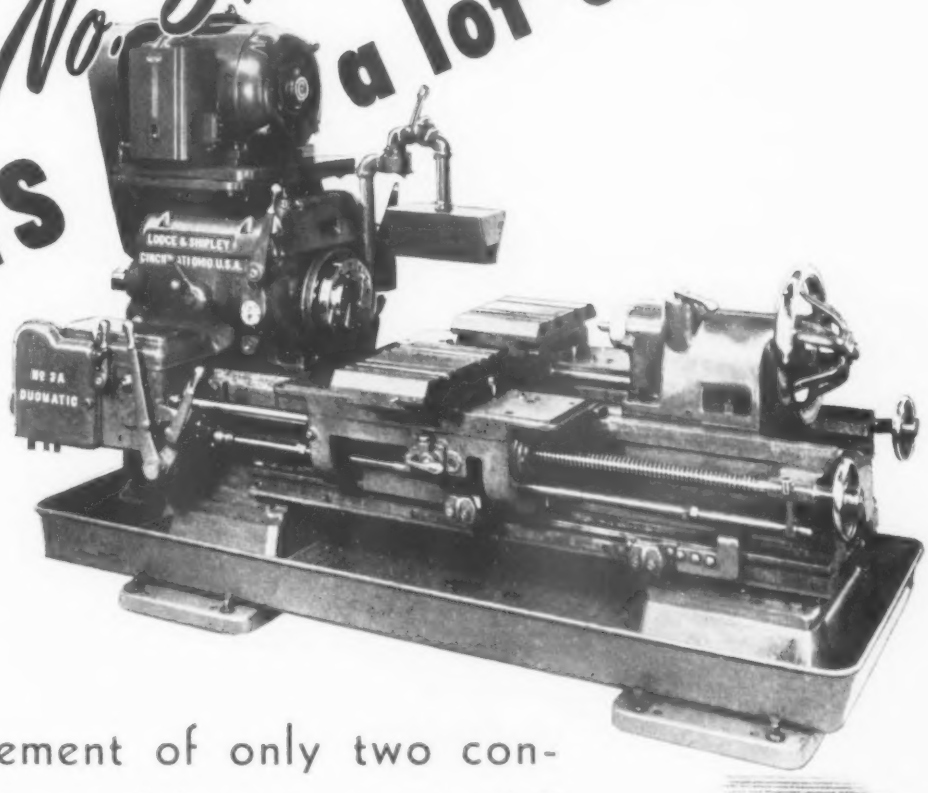
American management and industry already have done an immense war production job, but still greater effort must be put forth, said Harold V. Coes, President of the American Society of Mechanical Engineers, at that organization's spring convention in Davenport, Iowa.

Cooperation: Coes asserted that the United States had produced in about two years what it took Japan 30 years to do, Russia 20 years, and Germany 10 years. He called for cooperation between government and business and between management and labor.

"Speeding Production for Victory" was the theme of the three day meeting April 26-28. Another speaker at the convention dinner was Col. James Lawrence Walsh, Chairman of the War Production Committee of the

(Continued on page 124)

The No. 3A Duomatic SAVES a lot of Hands

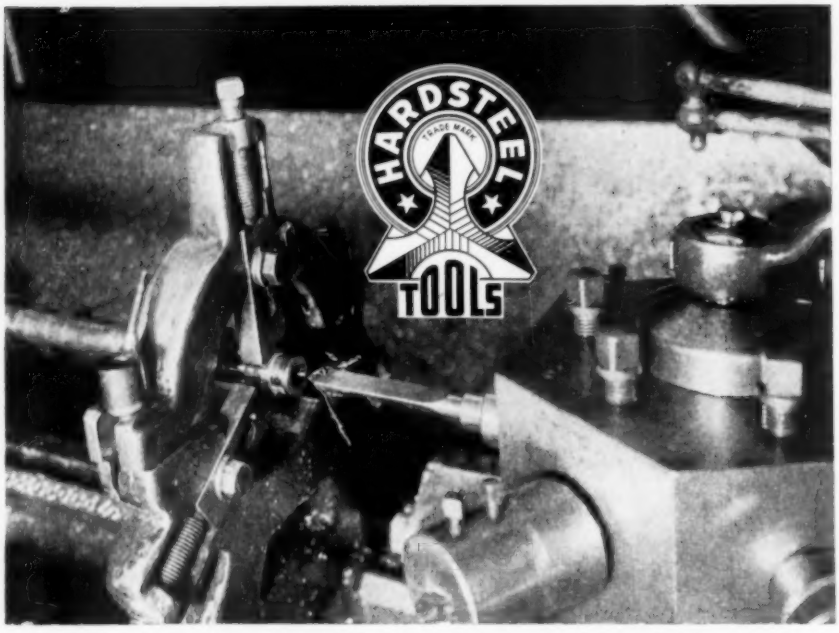


The movement of only two conveniently located levers puts the full automatic machining cycle in operation.

Write for fully illustrated Book No. 601-FL, completely covering the No. 3A Duomatic-Automatic Lathe.

THE LODGE & SHIPLEY MACHINE TOOL CO.
CINCINNATI, OHIO, U.S.A.

ENGINE TOOL ROOM AUTOMATIC LATHES



Drilling hardened steel Rolls-Royce camshaft with "HARDSTEEL" drill.

Eliminate Expensive Grinding

Drill Hardened Steel Parts with "HARDSTEEL" Drills

You can speed production and cut costs by eliminating grinding operations—simply use "HARDSTEEL" drills to drill, ream, countersink and counterbore steel parts hardened by any process—without annealing.

One manufacturer of push rods for aircraft engines saved $7500 annually on grinding wheels alone when "HARDSTEEL" drills made unnecessary a single grinding job.

"HARDSTEEL" drills work with ease in hardened steels —even in steels of the work hardening types. And the harder the material—the easier it is to drill.

Drill after hardening—cut your rejects—insure parts matching at assembly—by using this new drill according to the complete instructions in the "HARDSTEEL" Operator's Manual—24 pages of practical information—and yours for the asking. *Write for it today.*

BLACK DRILL COMPANY
5005 Euclid Avenue • Cleveland, Ohio

"YOU HARDEN IT... WE'LL DRILL IT"

"HARDSTEEL"
DRILLS • REAMERS • TOOL BITS • SPECIAL TOOLS

(Continued from page 122)
ASME and a Director of the Army Ordnance Association.

Pratt & Whitney Year Book now an annual institution

"How foolish our enemies are to imagine for even one minute that they can succeed in their aggressions against a nation of such men and women," said Clayton R. Burt, president of Pratt & Whitney Division Niles-Bement-Pond Co., after scanning his concern's 1942 War Year Book.

Colorful: Distributed to P & W's thousands of employees, this year's book illustrates in 444 photographs the production activities of one of the world's largest producers of machine tools and gages.

Now an annual institution, this book may be found in many a Connecticut home months from now. Describing how P & W contributed to the 1,300 million dollar volume of machine tools produced in the U. S. last year, the issue says regarding 1943 manpower problems, "It is to be hoped that in the future draft authorities will realize the vital part which supervisory personnel plays in the production of machine tools, small tools and gages."

Womanpower on the Job

Woman trainees for men's jobs on production lines at the two Cincinnati plants of Lodge & Shipley Machine Tool Company receive careful preparation for their jobs. An experienced instructor is shown teaching the women trainees to read mechanical drawings and their meanings through use of "glass houses" and patterns. New male employees "take the course" along with the women.

Business Notes: Purchases, expansions and new services

New plant: The Portman Machine Tool Company has acquired a new and larger factory in New Rochelle, New York. The move, made last month, was necessitated by growing production.

Industrial Florida: Traditionally the vacation land, Florida has a growing industrial background that may offer a substantial post-war market.

A new directory of Florida manufacturers lists alphabetically more than 3,000 active industrial firms, prod-

(Continued on page 126)

THE CINCINNATI SHAPER CO.

CINCINNATI OHIO U.S.A.

SHAPERS BRAKES SHEARS

This $\frac{3}{4}$" by 14-ft. Shear is typical of the Cincinnati line with capacities of $1\frac{1}{4}$" in thickness, 18-ft. in length, and capable of handling the toughest of materials . . . armor plate. These powerful Cincinnati All-Steel Shears . . . built like a machine tool and equipped with exclusive Cincinnati hydraulic holddowns . . . shear with micrometer accuracy.

Write for informative book S-3 on the complete line of Cincinnati Shapers.

SPEED TREAT STEEL

A MEDIUM HIGH CARBON OPEN HEARTH PRODUCT

ONE

Steel that gives you . . .

1. EXCELLENT MACHINABILITY
2. GREATLY EXTENDED TOOL LIFE
3. GOOD FINISHED PARTS . . .
4. HIGH PHYSICAL PROPERTIES
5. EXCELLENT IMPACT RESISTANCE
6. GOOD TORSIONAL VALUES . . .
7. MINIMUM DISTORTION . . .
8. FINE HEAT TREATABILITY

ACTUAL PHOTOGRAPH
Speed Treat Steel (.45 carbon) 1-inch cold drawn bar tied in a knot, cold, without fracture.

SPEED TREAT STEEL machines from 30% to 60% faster than other comparable steels such as 1035, 1040, 1045 and 10% to 25% faster than such steels as X1335 and X1340 . . . with a very HIGH finish and greatly increased tool life.

★ BUY WAR BONDS

WRITE US FOR DETAILS
Our metallurgists are at your service

Licensor
MONARCH STEEL COMPANY
HAMMOND · INDIANAPOLIS · CHICAGO

Licensee for Eastern States
THE FITZSIMONS COMPANY
YOUNGSTOWN, OHIO
PECKOVER'S LTD., Toronto, Canadian Distributor

MANUFACTURERS OF COLD FINISHED CARBON AND ALLOY STEEL BARS

(Continued from page 124)

ucts and location. Price of the directory: $1 (Florida State Chamber of Commerce, Jacksonville).

Name change: Producing thousands of parts in many kinds of metals, alloys, non-metallic compositions and fabrics, in addition to "brake shoes," the American Brake Shoe & Foundry Co., has long been known as "American Brake Shoe". Last month its board of directors voted to streamline its name, accept its customers' appellation.

New Owner: The Taylor Manufacturing Co., Milwaukee, has acquired the plant, equipment and all other assets of the Wright Rubber Products Co., Racine, Wisconsin. The Racine plant soon will resume manufacture of Wright products. It will be known as Wright Rubber Products Division of Taylor Manufacturing Co. Taylor also produces compression mold plastics, drill presses, hydraulic dynamometers and static balancing machines.

Women are Needed in War Plants

Cleveland's Mayor Frank Lausche, left, visits The Ohio Tool Co. display of machines designed for women, with L. E. Butzman.

The Ohio Tool Co., manufacturer of small arms ammunition tools, placed one of their nine-inch South Bend Lathes in the lobby of the Lowe's State Theater, Cleveland, for one month recently, and put a woman operator at work demonstrating how small arms ammunition tools are made.

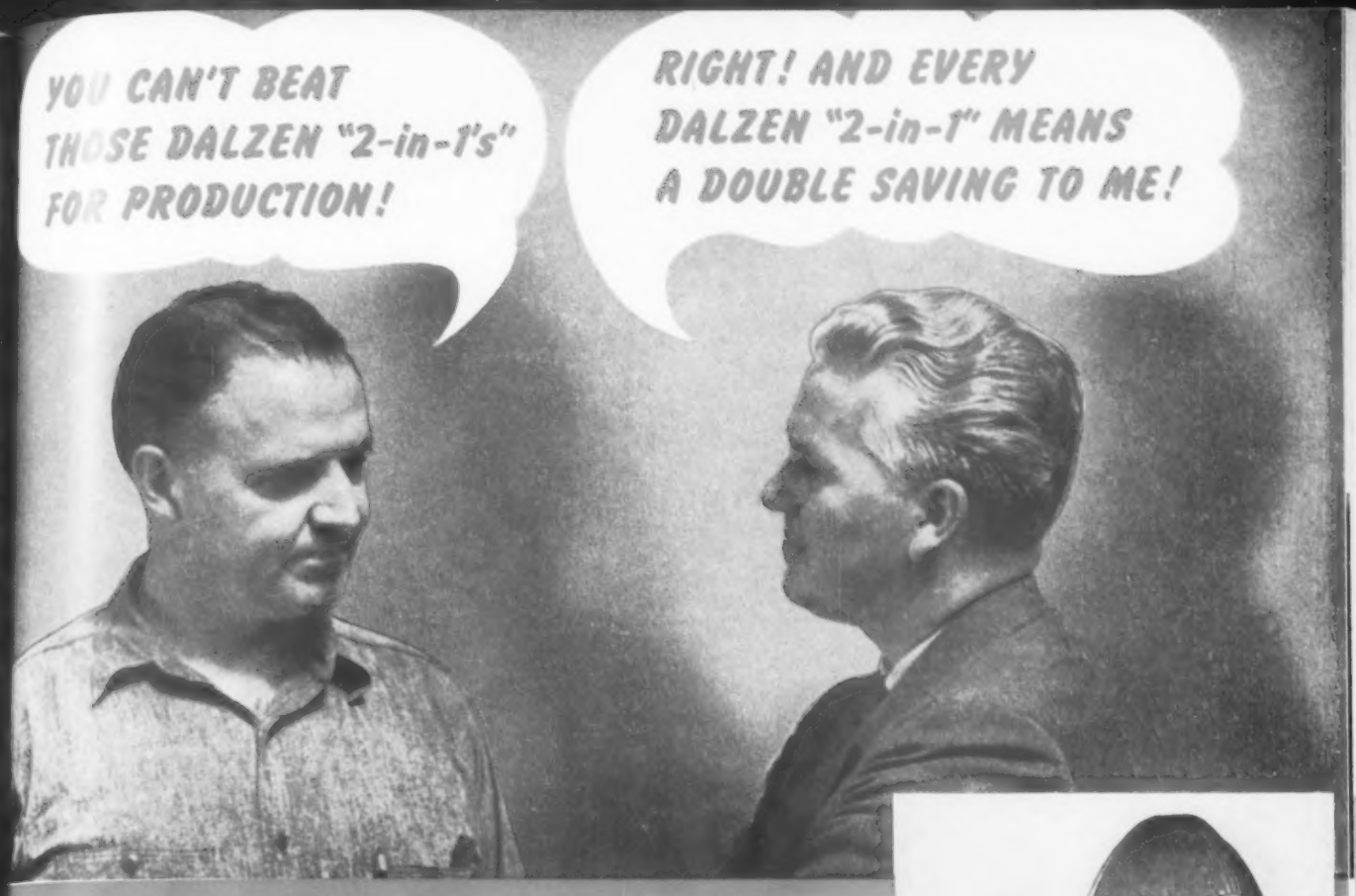
Purpose of the display was to stimulate interest among women in war plant work. Mayor Frank Lausche, of Cleveland, visiting the display, was curious to know how such a lathe operates. L. E. Butzman, Ohio Tool Co. head, gave the Mayor a demonstration.

Product rights: The Johnston & Jennings Co., Cleveland, manufacturer of tank fittings and industrial stokers, has purchased manufacturing and sales rights of Rusta-Restor, a cathodic process for preventing rusting of water tanks, piping and steel structures. This product is said to have won high commendation from municipal and industrial users.

Association: Pecker, Simpson & Gladeck, consulting engineers in Philadelphia, have become associated with the Langley Aviation Corp., headed by Vincent Bendix. Both organizations, active in the aeronautical field, have carried forward independent research in molding plywood beyond the methods presently employed in this art.

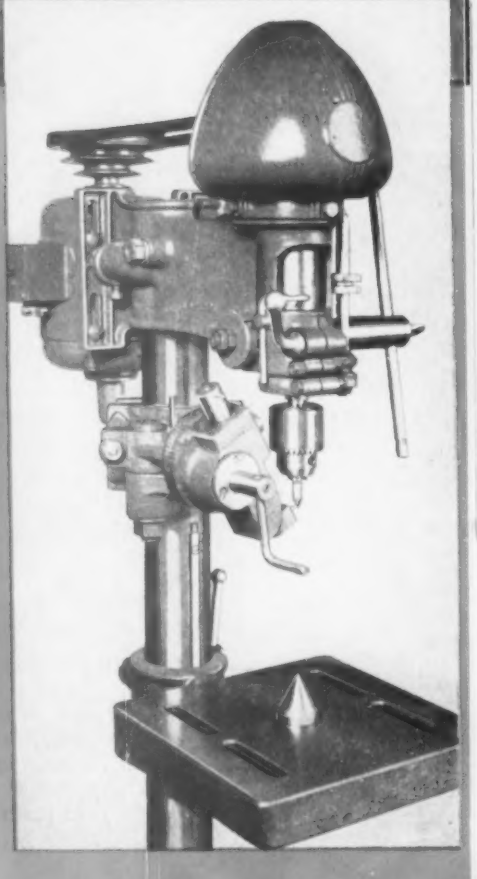
New plant: Completion of Colonial

(Concluded on page 129)



• The Dalzen "2-in-1"—combination center grinder and drill press—is priced sensibly, about half what you'd expect to pay elsewhere. Up-to-the-minute methods of manufacture, in Dalzen's modern plant, effect real savings in cost — savings that are passed along to you.

You save doubly because these same manufacturing methods give you a better machine, built for years of dependable service on a wide variety of work. Easy, rapid adjustment permits use as a center grinder or drill press at a moment's notice. Four-speed, V-belt drive will handle any type of work. Furnished complete with motor, diamond, and lapping stone. Prices and specifications rushed on receipt of letter, wire, or telephone call.



DALZEN

TOOL & MANUFACTURING CO.

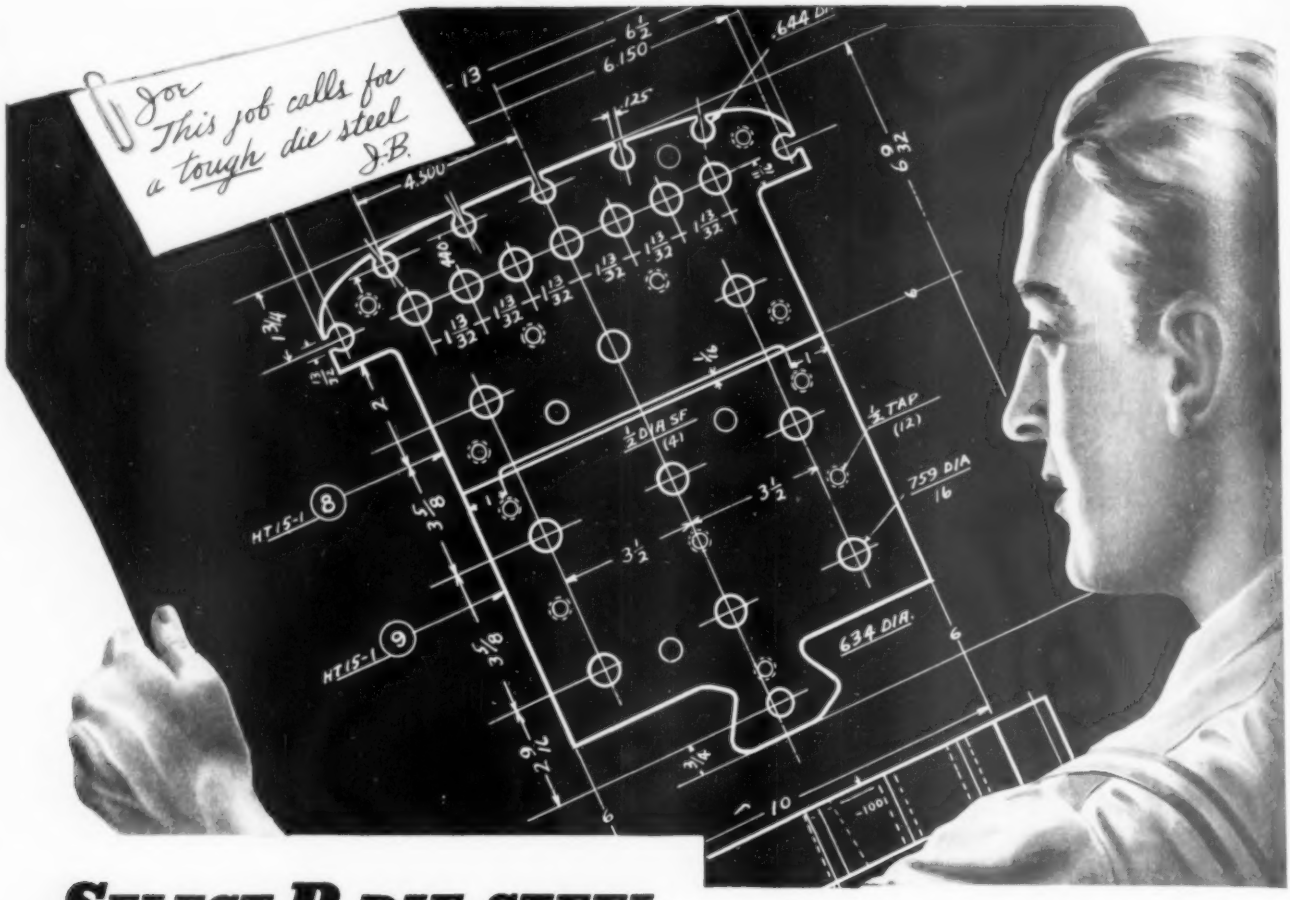
12255 EAST 8 MILE ROAD • DETROIT

A DALZEN *WILL DO IT!*

Dalzen tools — taps, flat and round broaches, thread milling hobs — have the same high reputation for accuracy and dependability as Dalzen Thread Grinders and Center Lapping Machines. Sturdy, compact, efficient, Dalzen machine tools give maximum production per cubic foot, per pound, per dollar of cost! Write for descriptive literature.

DALZEN IN AIRCRAFT

Ground thread parts are being produced on contract for leading aircraft engine manufacturers. For detailed data on this service, submit blueprints and specifications when making inquiry.



SELECT B DIE STEEL
... for toughness

"My problem is simply this: I have to choose a die steel that is tough and yet withstands considerable abrasion." So said a perplexed die shop superintendent recently to our metallurgical service man. "And don't forget," he added, "it has to machine easily, must be non-deforming and can't be ground after hardening — so the die must be free from scale or decarburization after heat treatment."

"Well, here is the answer," said the Latrobe Metallurgical Service Man. "It's *Select B* . . . a tough die steel that won't deform and will withstand abrasion. As far as heat treating, that is easy: Pack the die in sifted grey cast iron chips, dry charcoal or spent carburizing compound. Cast iron chips will prove preferable, since they won't build up carbon and cause brittleness of cutting edges.

"Since the dies are of a rather intricate nature, preheat at about 1400°F. As soon as they have become heated to this temperature bring furnace up to 1750–1775°F. Hold for just sufficient time for the container to become thoroughly heated, then remove the part and air cool in still air.

"When you can just about pick the dies up with your bare hand draw them at 900°F. The thickness being about 2½", hold for about four hours at this temperature. This will give a hardness of about Rockwell C-58 with the necessary toughness."

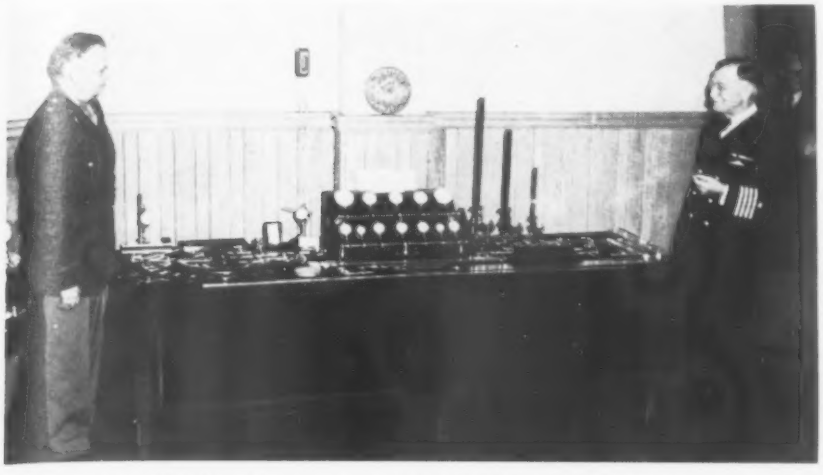
The result: This Company greatly simplified their die machinery problems, the production was increased and a substantial saving in their die steel costs was secured. It's a simple illustration of the timely help you can get to meet today's vital production problems with Latrobe Metallurgical Service. It's a technical help you can feel free to use. A special bulletin on "Select B" is available.

LESCO

TOOL STEELS FOR VICTORY

LATROBE
ELECTRIC STEEL COMPANY
MAIN OFFICES *and* PLANT • • • LATROBE • PA •

STARRETT WINS COMMENDATION



• After recent "E" Award presentation ceremonies at the Athol, Massachusetts, plant of The L. S. Starrett Company, General Burton O. Lewis, District Chief of the Boston Ordnance District, and Captain Gordon C. Hall, First Naval District, inspected some of the precision tools and gages made by Starrett.

(Continued from page 126)

Broach Company's new Detroit plant has been announced by Carl Halborg, president of the company. The plant more than quadruples the concern's productive floor space compared with its pre-war facilities available for broaches and broaching machines.

War plants: Standard Oil Company of Indiana and subsidiaries are completing or have under way construction of manufacturing facilities estimated to cost upward of $55,000,000. All will contribute directly to the war effort, E. G. Seubert, Standard Oil president stated. For the most part, they are financing the construction without aid from the government, he said.

WPB cites violations of regulations on gages and hand tools

Under an amendment to General Preference Order E-5-a, the WPB announced last month, purchasers of production and inspection gages of many types are not required to certify as to their inventories. Types of gages affected, the Board stated, include: round external, round internal, external thread, internal thread, snap, fixture and flat.

In a letter to producers and distributors of gages and precision hand tools, George H. Johnson, Director, Tools Division, WPB, cited violations of WPB regulations by war contractors. He stated that some contractors have been issuing "blanket" purchase orders to distributors of gages and precision hand tools, applying to such orders the contractor's maintenance, repair and operating supplies preference rating for tools to be held in the distributor's stock for sale exclusively to the particular contractor's employees.

"Such practice is a direct violation of Priorities Regulation No. 3 as well as General Preference Order E-5-a," he said. "No person may apply a rating to secure material being purchased not by the person applying the rating but on the contrary being bought and paid for by a third person. The only mechanism under which the contractor's rating may be used is that established by E-5-a."

Mr. Johnson directed that any inquiries regarding the amended E-5-a be addressed to Sam Wood, Gage and Precision Tool Section, Tools Division, WPB. The letter should be marked: "Reference: E-5-a."

Materials: More molly mined; Third-quarter allotments

Far beneath the slopes of the Continental Divide near the old mining town of Empire, Colorado, work is progressing 24 hours a day on the job of tapping rich veins of molybdenum ore, a new critical steel component.

Reserve: About 40 miles away is the World's largest blocked-out reserve of this ore, that of the famous Climax molybdenum mine at Bartlett Mountain, which is being worked night and day in turning out hundreds of tons of this element.

However, it is reported, the Government did not feel there was a sufficient reserve of the metal, and the Defense Plant Corp. bought the Urad molybdenum mine, which was operated during World War One by the Primos Corp., which took out about 100,000 tons of ore and later sold the property to the Vanadium Corp. of America, who did not develop it.

The DPC bought the mine last summer for $110,000, and contracted with the Molybdenum Corp. of America to operate it, under an agreement by which the corporation may acquire the mine after the war, if it wishes.

* *

Shortages: A continuing demand for materials outrunning the available supply was reflected in the third quarter allotments of Controlled Materials just completed by the Requirements Committee, WPB has announced.

The allotments of materials have been made to 14 claimant agencies representing military and civilian requirements, lend-lease and other export. Estimated third quarter supply of materials allotted by the Requirements Committee included nearly 15,000,000 tons of carbon steel, about 2,500,000 tons of alloy steel, over 1,000,000 tons of copper products, and nearly 660,000,000 pounds of aluminum. WPB withholds distribution details for military security.

Motor Manufacturing Memos: The Industry looks to peace

They aren't slowing up on war production, but auto industry leaders from master mechanics up are beginning to look beyond the task of building weapons. They have unsnarled most of the knots in war production tooling and are contemplating post-war manufacture.

Market: The size of a manufacturing executive's job in the industry is related directly to the size of the market he must supply. And post-war prognostications indicate an automotive market after the war 50 per cent greater than in the boom year of 1941. Consequently, production men want to know what kind of a car they will be asked to build. The stock answer in Detroit is "the same kind you built before the war."

But designers know this will be true only for the first year or two. Many an old-time auto production man is in for a jolt unless he prepares himself to handle new materials and new shapes.

The cars on the drawing boards in the plants of West Coast plane manufacturers feature plastic bodies and plastic trim. Metal, it is contemplated by the would-be auto builders, will be cut to a minimum. Light motors will produce 40 to 50 miles per gallon of gas.

Many a metal fabricating man in the auto industry is beginning to wonder.

* *

Output: Late last month the industry's Council for War Production explained some of the interruptions in war production schedules in its nationwide plants.

Summed up, the Council said the industry has passed from the give-us-everything-you-can period which prevailed for months after Pearl Harbor, into a period where the production of weapons is on a highly selective basis depending on the strategical requirements.

Two reasons stand out: So terrific is the industry's appetite for raw materials, now that it is completely tooled up, that the nation is unable to supply materials needed to keep every assembly line moving full tilt; and changes in military design, now becoming more frequent as weapons are tested in battle, affect the main assembly line, the main plant, or many of the subcontracting suppliers' plants.

Despite such disconcerting changes, which have manifested themselves with accelerating frequency of late, the automotive industry is producing at a rate of nearly $1,000,000 an hour.

* *

Another Gargantua: Rivaling in size Ford's Willow Run, Bell's Atlanta plant and Dodge's Chicago factory, the little mentioned Fisher Cleveland Air-

(Continued on page 130)

TO PLANT OFFICIALS CONCERNED WITH INCREASING WAR PRODUCTION...

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LATEST *Complete* INFORMATION ON PRECISION GAGES, JIGS, FIXTURES and DIES...

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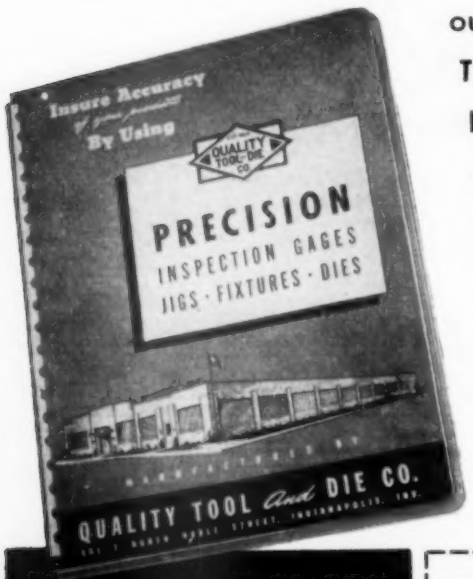

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(Continued from page 129)

craft Plant was completed with a notable absence of fanfare last month.

One of the largest aeronautical projects undertaken by the auto industry, the factory was built and will be operated by General Motor's Fisher Body Division. The Ohio factory was designed specifically for mass-producing the Army's newest and longest-range bomber. The plane will dwarf the Flying Fortress and Liberator.

Conscious of the Willow Run public relations fiasco, GM engineers emphasize that a tremendous amount of tooling is yet to be completed. The only indication of size passed by censorship is the plant site area. It is more than 400 acres.

* *

Ford: While at work on the job of retooling to increase radial engine output four times, this second largest autobuilder has gone into full production of turbo-superchargers. These delicately machined turbines force great quantities of air into aircraft engine to obtain greater horsepower.

Using General Electric's design, Ford has turned out several thousand of the machines in a plant where automobile bodies previously were built. Ford supercharger production is notable for the development and adoption of several manufacturing methods which save materials and machines.

Engineers at Dearborn have successfully substituted low carbon steel for 37 pounds of aluminum in the construction of the supercharger's compressor casing. Taking a GE idea, they perfected it by utilizing experience acquired in making dies for automobile stampings and developing deep draw sections.

Another change developed by Ford has been the butt welding of the forged wheel to the steel shaft in the rotor assembly, reducing to one piece what formerly was a precision fit of the two pieces held together by three bolts. This is the most vital part of the turbo-supercharger, since this wheel and shaft weighing 22 pounds, spins at more than 20,000 rpm.

One hundred and forty-four small buckets are welded to the rim of this turbine wheel and provide a means of applying the kinetic energy of the exhaust velocity to produce power to drive the rotor shaft.

Ford engineers also have made several contributions toward redesigning the original fabricated nozzle box, parts of which also are stamped out on large presses. Spot-welding and seam-welding have been applied in building the nozzle box and compressor casing.

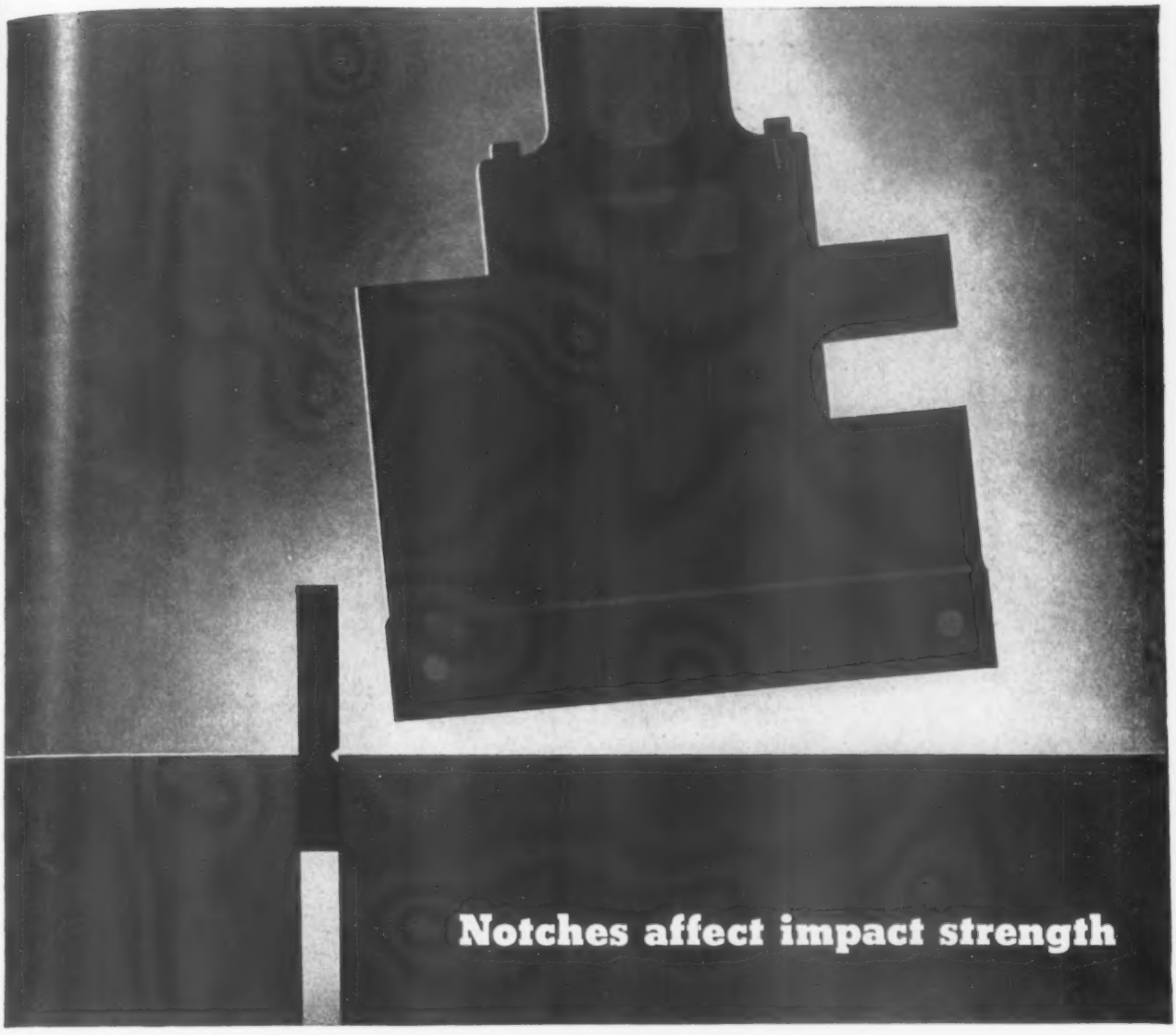
* *

Hudson: Who makes what and where has been the number one mystery of the American war production front for the past year. As more and more materiel gets into battle, censorship is beginning to loosen up.

One result was the revelation last month that important suspension units for the new American M-5 light tank have been produced and shipped in mounting volume for months by this automobile concern.

The parts are all made on converted automobile machinery. This war job required more than 500 special tools, jigs and fixtures and involved the conversion of more than 200 machines according to Hudson engineers.

THE END.



Information supplied by an Industrial Publication

The effect of fillet radius on the life of machine parts operating under alternating stress has been known for a long time. The knowledge has been put to good use in designing parts so as to avoid fatigue failures.

The effect of variation in the notch radius of Izod impact bars has shown the way towards the elimination of impact failures in filleted parts.

Two sets of standard size impact bars were machined from one heat of steel, both with a 45° notch. In one set the notch radius was 0.01 inch and in the other 0.05 inch. After quenching, and in some cases tempering, the bars with 0.05 inch radius consistently showed about 140% improvement in impact strength.

The practical application of these results, which consisted of increasing the existing fillet radius, has eliminated impact failures in a part where the problem had become serious.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

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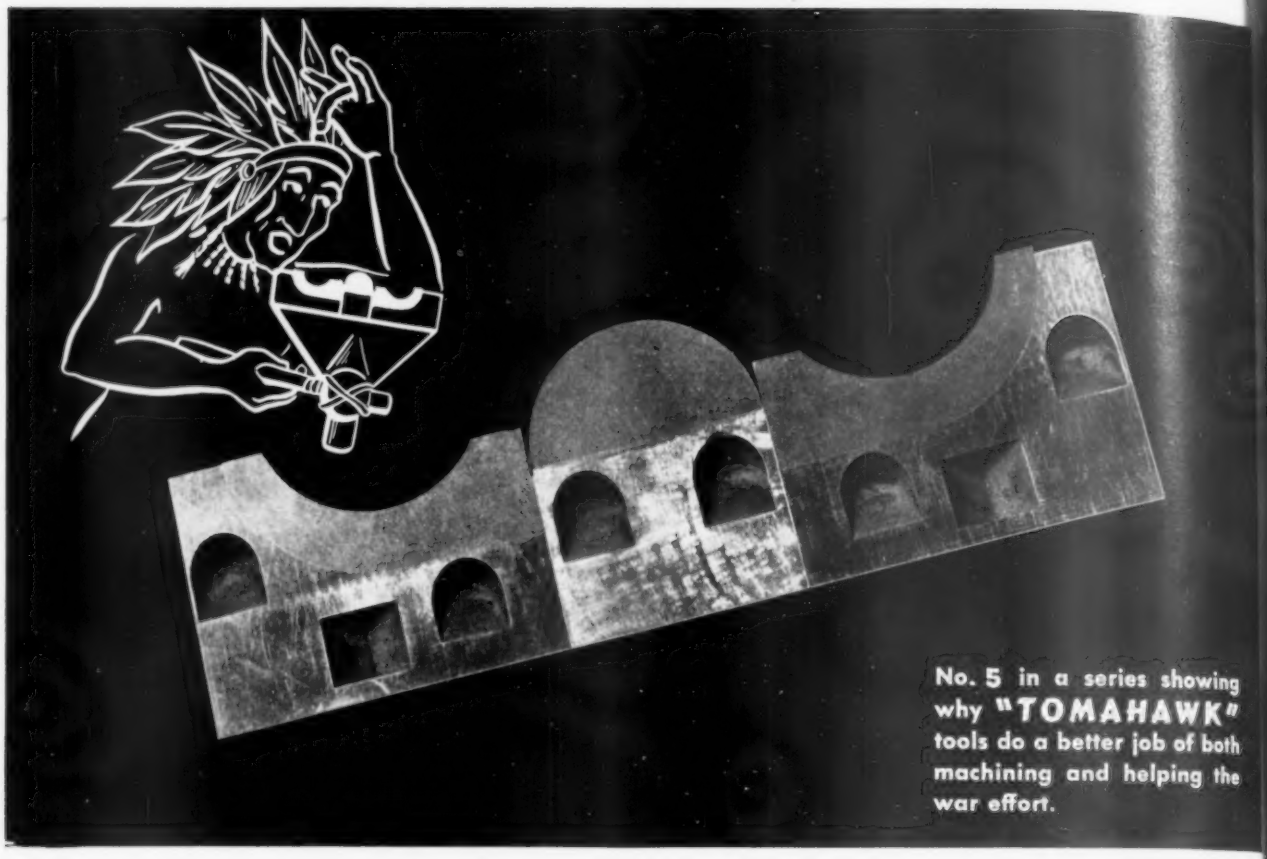


Something Indians didn't know about "TOMAHAWKS"

One big three-piece carbide tipped **"TOMAHAWK"** form tool like this may save several times its weight in precious tungsten in the form of high speed tools of shorter life.

Splitting the 10 inches of total length of carbide tip into 3 sections also simplifies and speeds manufacture, simplifies sharpening and set-up, increases overall tool life and reduces replacement cost in case of damage.

Size of a tool in itself is no bar to the efficient use of carbides.. Genesee will be glad to advise you as to the desirability of tipping big as well as small tools with carbides.

GENESEE TOOL COMPANY

FENTON, MICHIGAN

★ Registered Trade Mark

PRODUCTION PIX

WHAT'S DOING IN THE WORLD OF MASS MANUFACTURING

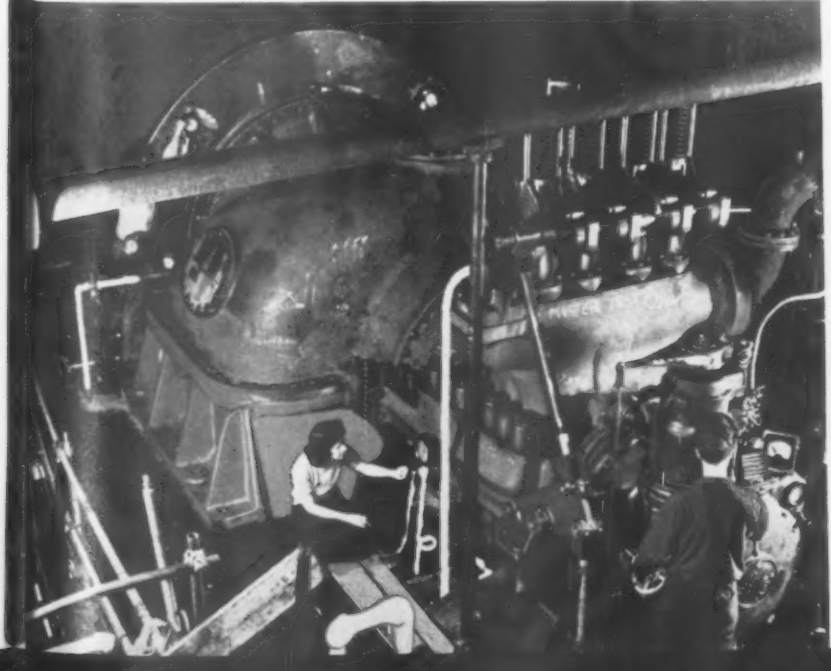
ght—At one stroke of the press 10 holes are pierced in
barrel jacket of the machine gun manufactured by Gen-
l Motors' AC Spark Plug Division. GM has achieved a
ving of $40 per gun through metallurgical developments.

ell gage in operation that won for two
illys-Overland employees, Frank Speke
eft) and Clarence Reynolds (center), one
the four annual American Design Awards.
e projectile is 155 mm.

Womanpower is now a prime factor in mass production. Ruth Beard, one of the women tire builders replacing men at U. S. Rubber's Fisk plant lifts from the machine a tire she has just built.

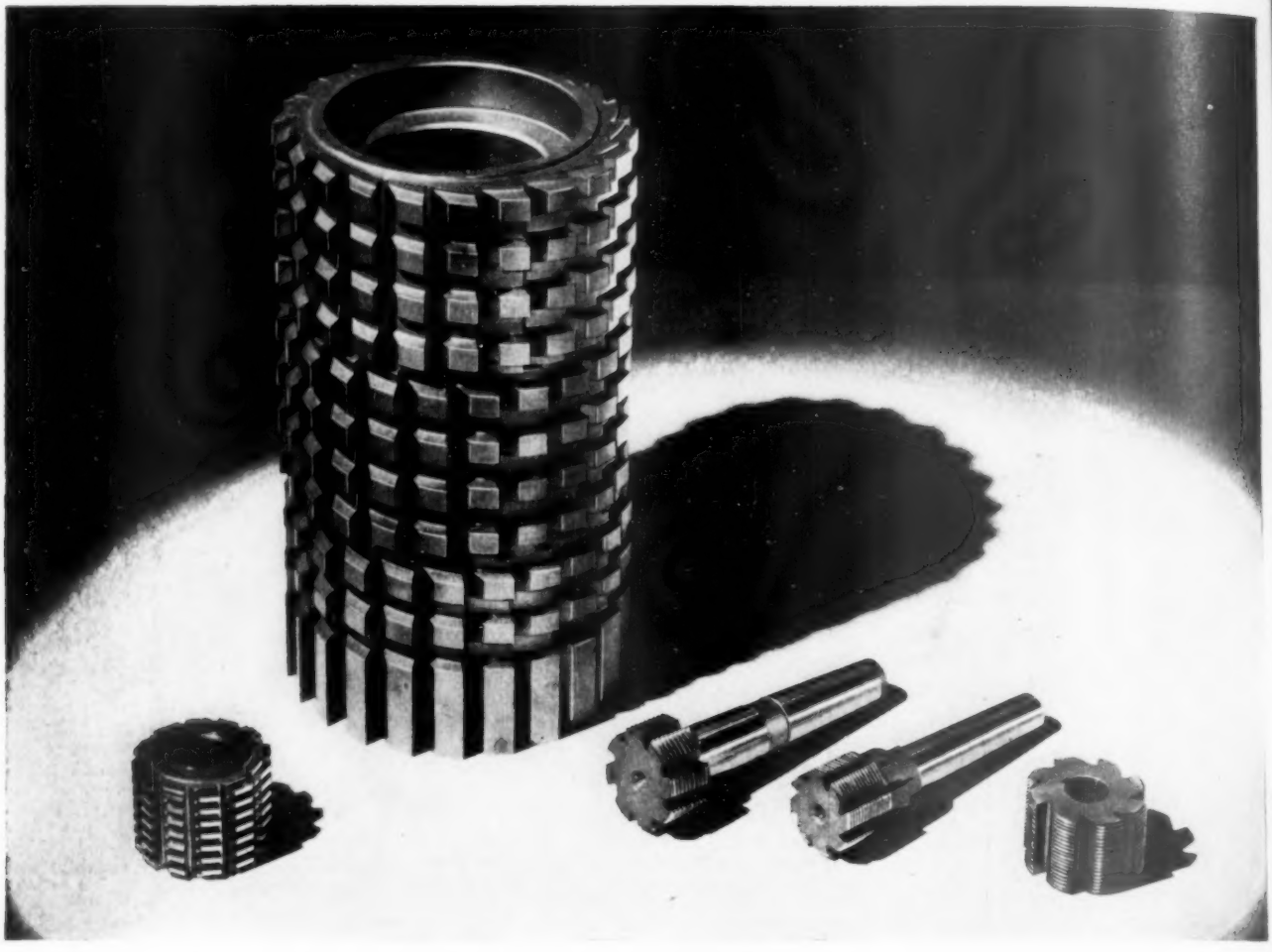
Famed Dr. Willard Dow watches the first ingot poured in the new Dow-operated magnesium plant in Michigan. Dow production is now 35 times that in 1939.

lmination of a tremendous production job is the testing of this 30,000-kilowatt tur-
ne generator, one of four General Electric is building for floating power plants ordered
the Power Division of the WPB. The floating plants will be towed to U. S. manu-
cturing areas on inland waterways to provide additional or emergency electrical power.



Robert E. Johnson, chief field engineer of Wright Aeronautical examines the Japanese-made slide rule he used in making calculations on engine performance for the Army's Tokio raid last year.

PLAN-O-MILL



THREAD MILLING CUTTERS

Years of on-the-job experience—working with production men all over the country as each Plan-O-Mill milling machine was tooled for another job—told Plan-O-Mill engineers exactly what was needed for accurate, economical thread milling.

The result is the Plan-O-Mill Multiple Thread Milling Cutter, now proving its worth in factories and machine shops from coast to coast.

Plan-O-Mill Thread milling cutters are available ground or unground with straight or spiral flutes, in National, Whitworth, Acme, V, and special forms, for use on all types of thread milling machines. For speedy delivery give full details when ordering, including size of cutter; thread form, pitch, and direction; straight or spiral gash, and job description.

MILLING MACHINES

PLAN-O-MILL

MILLING CUTTERS

PLAN-O-MILL CORPORATION, 1511 E. Eight Mile Road, Hazel Park, Mich.

TO THE MANUFACTURER

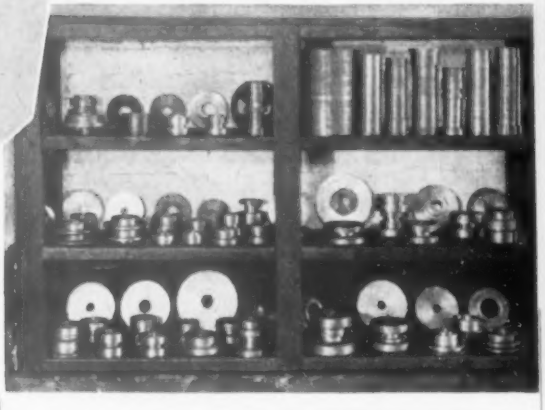
not get turning short runs

ON HIGH PRODUCTION AUTOMATIC LATHES

THESE CAST-IRON, STEEL AND BRONZE PARTS ARE TURNED **IN LOTS OF 25 TO 100** ON SUNDSTRAND AUTOMATIC LATHES WITH SAVINGS IN TIME UP TO **95%**

(Above) Two Sundstrand Model 10 Automatic Lathes for rough and finish turning parts on short-run work.

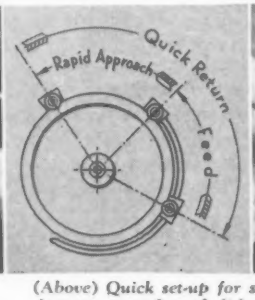
(Left) Rough sleeve blank, rough turned part, and finish turned part.

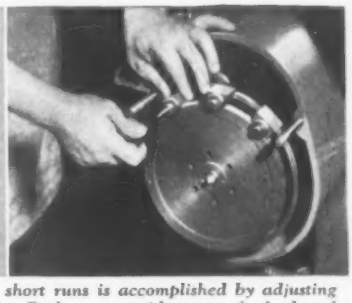


Quicker Set-ups for Short Runs

How the Sundstrand Quick Cycle Change speeds up production on short-run work.

(Above) Close-up view of tooling set-up for rough turning sleeve.





(Above) Quick set-up for short runs is accomplished by adjusting dogs on a graduated disk. Cycles are rapid approach, feed and quick return of 250" per minute. No cycle control cams are required.

Quicker set-up and easy change-over are possible with this simple cycle control. It eliminates making cams for every job to be turned. It provides complete control of all cycles by simple adjustment of dogs on a disk. Disk is graduated for ease and speed in setting up cycles, and changing from one job to another.

A total of six dogs controls all cycles. These provide control for conventional as well as intricate cycles. Rapid return is 250" per minute, and occurs immediately after cutting cycle is completed...no wait for cams to complete rotation.

Wide Range of Tool Action

A wide range of action for front carriage tools is provided by three units which can be used separately or in combination to give (1) angular feed-in and tool relief . . . (2) slow-up and dwell . . . (3) straight feed-in and tool relief. Many combinations are possible by merely making simple adjustments.

Easy to Operate

Unskilled help can consistently produce work to close limits with a Sundstrand Lathe. The operator merely changes work pieces and starts the automatic cycle. Usually one operator can handle two or more machines.

If you are not now getting the advantages of production turning on short-run work, investigate the possibilities of Sundstrand Automatic Lathes.

Turning Time Reduced from 75 Minutes to 4 Minutes . . .

On Lots of 40

This progressive machine manufacturer increased production on more than 100 different short-run turning jobs. The parts include simple gear blanks, cluster gears, sprockets, pulleys, sleeves, etc., in lots of 25 to 100.

Set-up Time 45 Minutes

This sleeve was formerly machined in one hour and fifteen minutes. Two Sundstrand Automatic Lathes now rough and finish turn it in 4 minutes. The part is rough turned on one lathe, finished on the other. The Sundstrand quick cycle change makes possible setting up each machine in approximately 45 minutes. The parts are run in lots of 40, with one man operating both machines.

Let Sundstrand Engineers Help You With Your Turning Problems . . .

Let our engineers assist you in the selection of the proper automatic lathe for your job, and make tooling suggestions for faster turning of *both* short and long-run work. With wide experience on tooling for turning and milling, this competent staff of engineers is available, without obligation, to study your machining problems, and to suggest changes which will increase production, lower costs. Use this service freely. Send complete, accurate information with each inquiry.

How to Turn Short-run Work Faster . . .

is illustrated in this 16-page booklet describing the features of the Sundstrand Automatic Lathes. The quick set-up and easy change-over features are described in detail. Twenty-two front and six rear carriage cycle diagrams are also illustrated and described. Write for your copy today. Ask for Bulletin No. 813.

SUNDSTRAND MACHINE TOOL CO.

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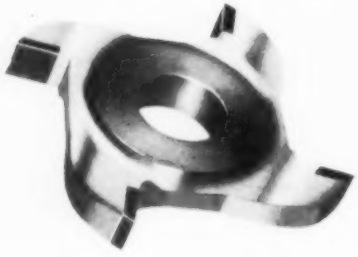


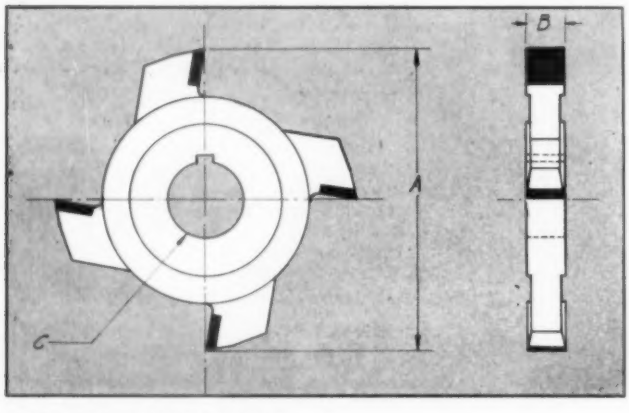
NOW Quickly Available... SUPER *Carbide-Tipped* STANDARD MILLING CUTTERS

NEW DESIGNS EXTEND USE

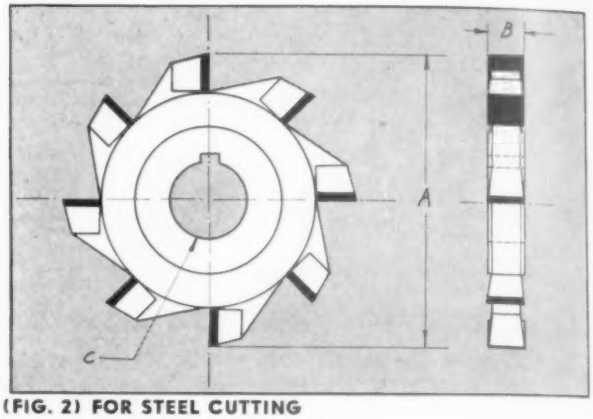
No longer is it necessary to limit the use of tungsten carbide-tipped milling cutters only to long run jobs on which the cost of expensive tools could be profitably absorbed. Super Tool Company's new design of standard side and face mills with cast alloy bodies and the minimum number of flutes reduces the cost of carbide-tipped milling cutters and extends their practical use to short runs and general shop tooling.

FASTER MILLING . . . GREATER ACCURACY

These new type cutters provide the important advantages long associated with carbide-tipped tools. One advantage is faster milling. The higher cutting speeds at which it is possible to operate the carbide-tipped cutter lead to increased table feeds, despite the reduction of feed per tooth per revolution. Greater accuracy is also attained at the higher operating speeds. The feed per tooth being lower, the cutting pressure is lessened and consequently there is less distortion of the work. Many jobs are now being run successfully in steel at surface speeds of 400 to 800 feet per minute with tooth load varying from .0005" to .0025" with the hardness of steel.



(FIG. 1) FOR CAST IRON



(FIG. 2) FOR STEEL CUTTING

STANDARD CUTTERS FOR ALL MATERIALS

Standard cutters for cast iron, brass, bronze, copper, aluminum, magnesium, plastics, etc., are supplied promptly from stock in diameters from 3" to 6", in a variety of widths, and with 4 or 6 flutes. (See Fig. 1). For cutting steel, these sizes have 6 to 12 flutes, according to diameter. (See Fig. 2).

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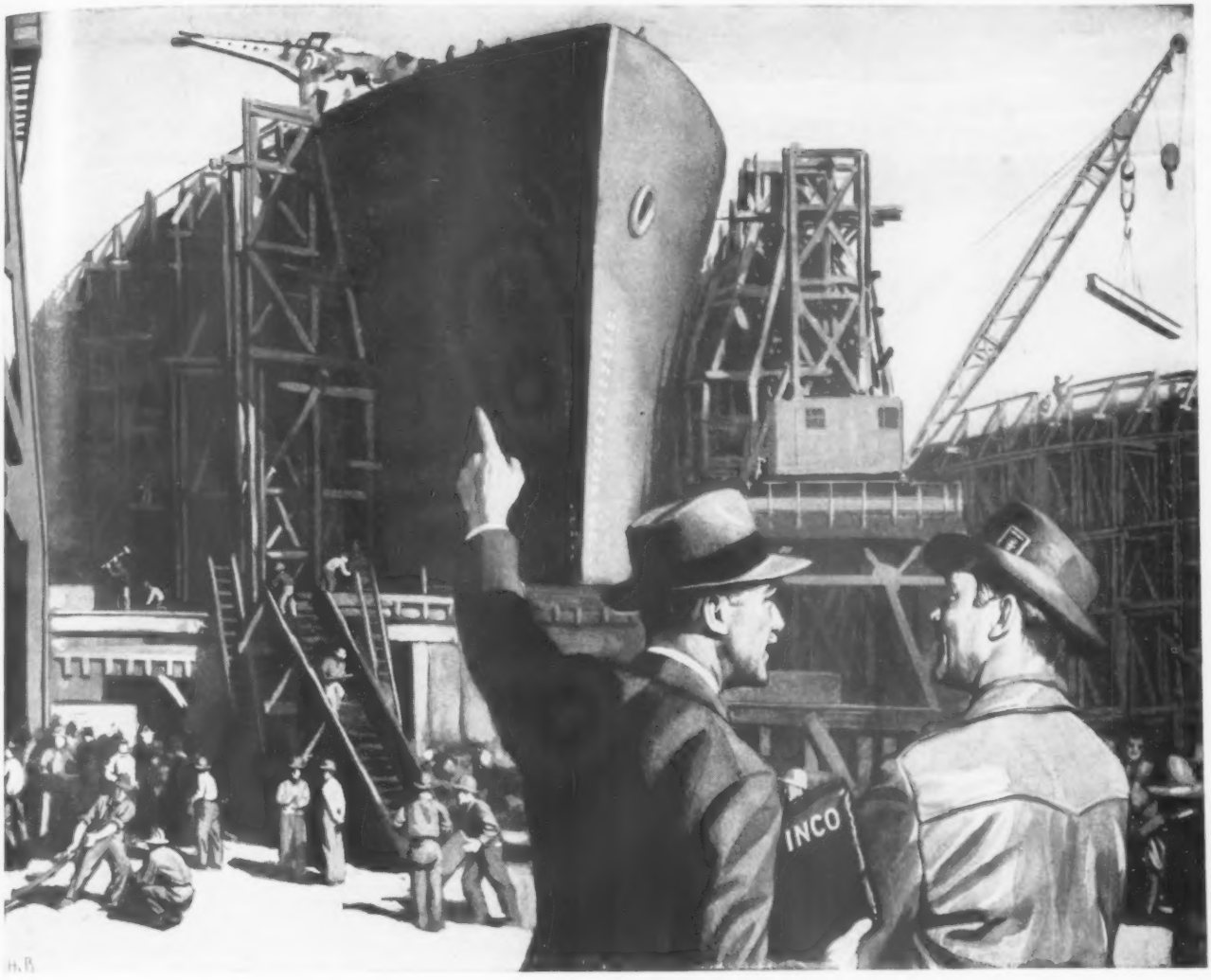
GROOVING • COUNTERBORING • SHAVING • CENTERS • SPECIAL PURPOSES



NICKEL AIDS THE MARINE INDUSTRY

to KEEP 'EM SAILING!

"Uncle *Needs* His Ships." That sign in a shipyard, a thousand miles from the sea, typifies the fighting spirit of America's ship builders. These men will turn out new tonnage faster than Axis bombs and torpedoes can sink it.

In peacetime, their engineering-thinking created efficient power plants that pushed ships of commerce through the seven seas. They designed propelling machinery—turbines, valves, pumps and gears—to move the ship and intricate instruments to guide and guard it on its important mission.

From turbine rotors to propeller shafts, from reduction gears to condenser tubes, those engineers relied upon ferrous and non-ferrous alloys strengthened and toughened by additions of Nickel. They used the properties of Nickel to fight corrosion and fatigue.

During wartime, when uninterrupted operation of America's bridge of ships means so much, the continued and widespread use of Nickel is convincing evidence of its many advantages. Now that sea-going metals must withstand repeated demands for stepped-up performance, a little Nickel goes a long way to insure utmost dependability.

Marine engineers and designers have long known and builders and fitters... as well as repair crews at bases 'round the globe... are learning that, properly used, a little Nickel goes a long way to "keep 'em sailing."

For years the technical staffs of International Nickel have been privileged to cooperate with the men who build and operate ships of all types. Counsel, and printed data about the selection, fabrication and heat treatment of Nickel alloyed materials, is available upon request.

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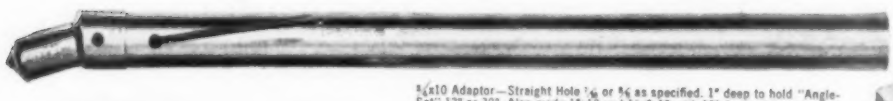
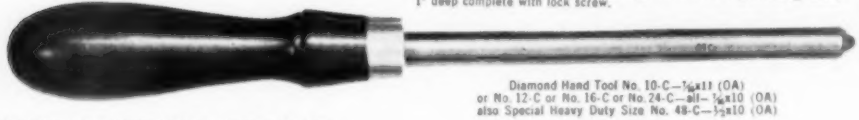


1/4x10 Adaptor—Straight Hole 1/16 or 5/64 as specified. 1" deep to hold "Angle-Set" 12° or 30°. Also made 1"x10 and 1 1/4"x10 with 12° Angle Hole 1/16" diam. 1" deep complete with lock screw.



Diamond Hand Tool No. 10-C—1/16x11 (OA)
or No. 12-C or No. 16-C or No. 24-C—all—1/16x10 (OA)
also Special Heavy Duty Size No. 48-C—1/32x10 (OA)

"Angle-Set-Magnet-Block" 2 1/2x3x1
Three units—Block, 12° "Angle-Set" and BIG-HED-NIB with No. 10-CNX Diamond Special—$25.00 Complete

RESETABLE LOC-KEY-SET RE-Setting $1.00 each tool. Mailing envelopes Free to Victory Plants, Grinders' instruction card free.

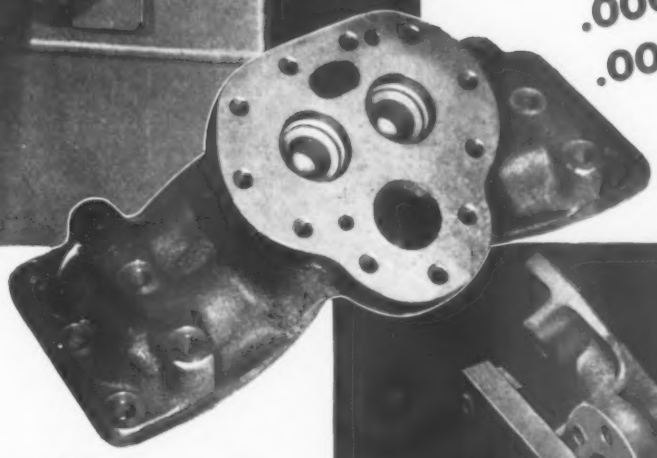
INSTRUCTIONS FOR ORDERING: Number of each tool pictured is eight times the diamond size contained in tool, and is two times the diameter of grinding wheel each tool is suited for. Example—For ½ carat number of tool is 4, and it is suitable for 2-inch wheel; for 3 carats number is 24, suitable for 12-inch wheel. NOTE: Above recommended sizes are for heavy production and include an added 50% safety allowance. For light work add ½ diameter to recommended wheel size. Diamond weights are stamped on all tools where space permits. Form Tool Diamonds: Special tools made from customers' prints and specifications.

Patents Pending. Copyright 1943 Diamond Tool Company, not inc. Chicago, Ill.

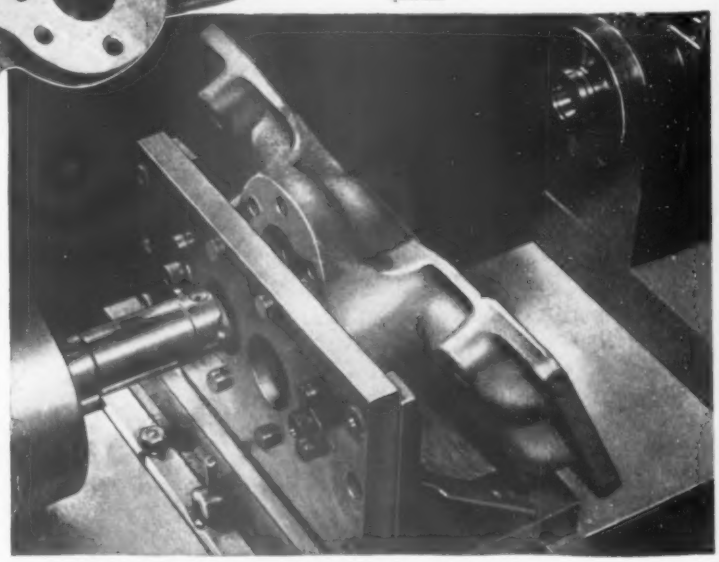
Two Bearing Seats in Pump Manifold Precision Bored to These Tolerances:

.0003" in Location
.0005" in Diameter

(Above) *This versatile Stokerunit Simplex Double-End Precision Boring Machine offers a wide range of applications.*



(Left) *Pump manifold, showing the two ball bearing seats. Extreme location and diametrical accuracy is required.*



(Above) *Special fixture is indexed by hand in precision boring second seat. Boring time is 35 seconds per seat.*

Actual Boring Time 35 Seconds per Seat on STOKERUNIT SIMPLEX *Precision* BORING MACHINE

On this job, extreme accuracy is indispensable in the line-up of ball bearing seats in pump manifold and cover. Diametrical accuracy is of equal importance.

The Stokerunit Simplex machine precision bores each seat in the manifold in 35 seconds, holding location to within .0003", diameter to within .0005", and the depth to .001".

By consistently maintaining these close tolerances, Stokerunit Simplex equipment has substantially reduced the number of throw-outs experienced on other equipment previously used. In addition, a polish finish is maintained.

Additional Data: Dia. of bore 2.0472"; depth .602"; stock removal 1/32". Stock, cast iron, Brinell 180-200; cutter, tungsten carbide. Spindle speed 400 r.p.m.; feed 2 3/8" per min. Indexed by hand.

Versatility as well as Accuracy and Speed

The Stokerunit Simplex Precision Boring Machine used on this job is the Series 200 3-Spindle Double-End. Each end being individually driven, only the single-spindle end is in operation in precision boring these pump manifolds.

Because of its versatility, this same double-end machine with different fixtures is used in precison boring various parts for a full range of differently sized pumps.

The same adaptability to a wide variety of work is available to solve *your* precision boring problems. Over 25 models of Stokerunit Simplex Precision Boring Machines cover practically the entire range of precision boring applications. They can be furnished in mechanical or hydraulic feeds, with single or multiple spindles, for short-run or production work.

Get the complete Stokerunit story now. For specific recommendations, send blueprints of parts with your production requirements. No obligation.

WRITE TODAY for these two booklets covering our entire line of Simplex Precision Boring Machines. Complete data and specifications are included.

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SIGNERS AND BUILDERS OF PRECISION BORING MACHINES AND MILLING MACHINES

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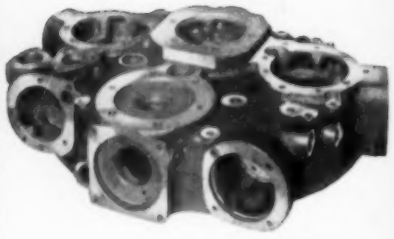
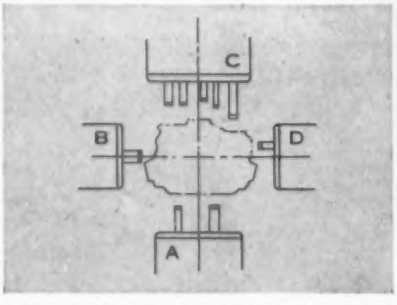
COMBINING OPERATIONS SAVED 71% IN MACHINING TIME... ON AIRPLANE ENGINE CRANKCASE



Aluminum Rear Crankcase
For Radial Airplane Engine

PART TOOLING AND OPERATIONS



Schematic diagram (plan view) of tooling used on four-way unit-type machine. Operations performed by each unit are listed below.

No. of Spindles — Nine

Unit A – 1 – .5625 dia. of drill
1 – combination 1.031 drill, 90° x 3/64 chamfer and face 1⅝ face.

Unit B – 1 – combination drill .5625 and .4687 dia. hole.

Unit C – 2 – .2344 dia. drill.
1 – 1405 drill 1⅜ deep.
1 – .1610 drill 2" deep.
1 – drill .9375, 90° x 3/64 chamfer and face 1-7/16.

Unit D – 1 – drill .5625, chamfer 90° x 1/32 chamfer and face 1⅛ dia.

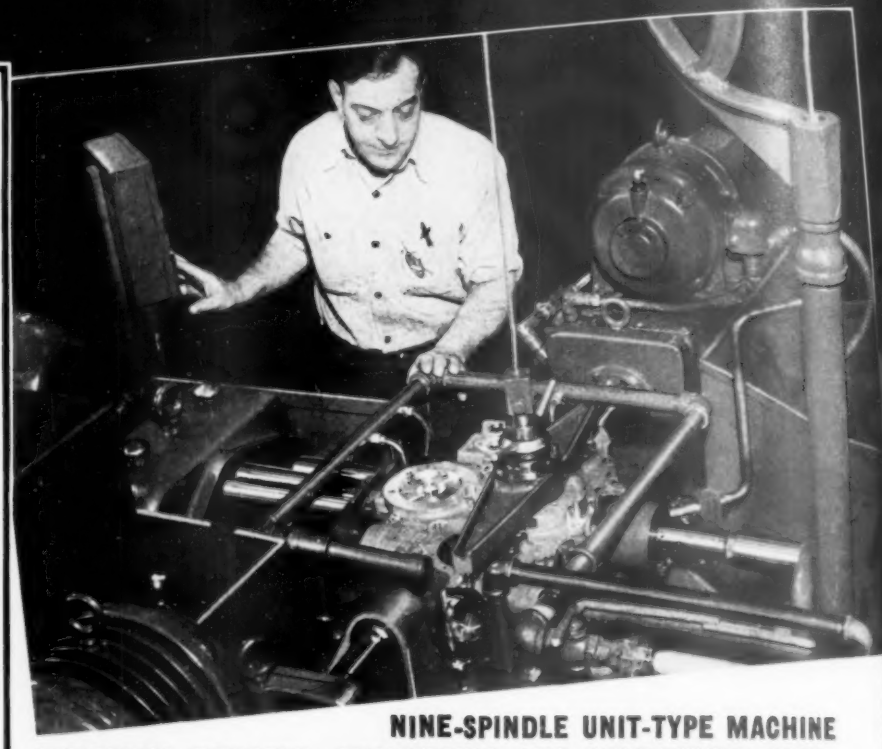
Type of Cutting Material — H.S.S.

Accuracies — Diameters ± .004" — .003". Locations ± .005".

●

MORE PRODUCTION AND TOOLING IDEAS

FREE Not a catalog, but a set of eight bulletins describing a better way to get better machines. Each bulletin traces a machining problem from the original study of the part to the final machine design. Each may suggest a more productive tooling set-up that you can use today — valuable file information for tomorrow. Write for bulletins: 6-43.



NINE-SPINDLE UNIT-TYPE MACHINE PERFORMS DRILLING, CHAMFERING AND SPOT-FACING OPERATIONS . . . REPLACES TWO MACHINES

Two standard machine tools were formerly used to perform the operations now done on this Unit-Type special machine. The former machining time was 3½ minutes, present time is only 1 minute. The operations covered are listed in detail in the column at the left. The machine is our Unit-Type production machine so widely used in the Automotive Industries prior to the war. These machines have found wide acceptance in aircraft and armament plants whose volume and speed of production requires equipment of special single purpose production capabilities, yet flexible enough for quick conversion to meet minor part design changes.

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W. F. & JOHN BARNES

W. F. and JOHN BARNES

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Photos courtesy Kearney & Trecker Corp.

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SPECIFY LOVEJOY MILLING CUTTERS ON JOBS LIKE THIS

KEARNEY & TRECKER CORPORATION uses Lovejoy Type "A" Milling Cutters with positive-locking Lovejoy Blades on the milling job shown here. Lovejoy cutters are free cutting—they enhance the accuracy of milling and boring machines by reducing spindle strain and eliminating the "climbing" action of the cutter. Power consumption is thus reduced to a minimum.

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Try a Lovejoy on husky jobs like the big "Milwaukee" bed casting shown here — it will soon prove its accuracy, economy, and free-cutting qualities.

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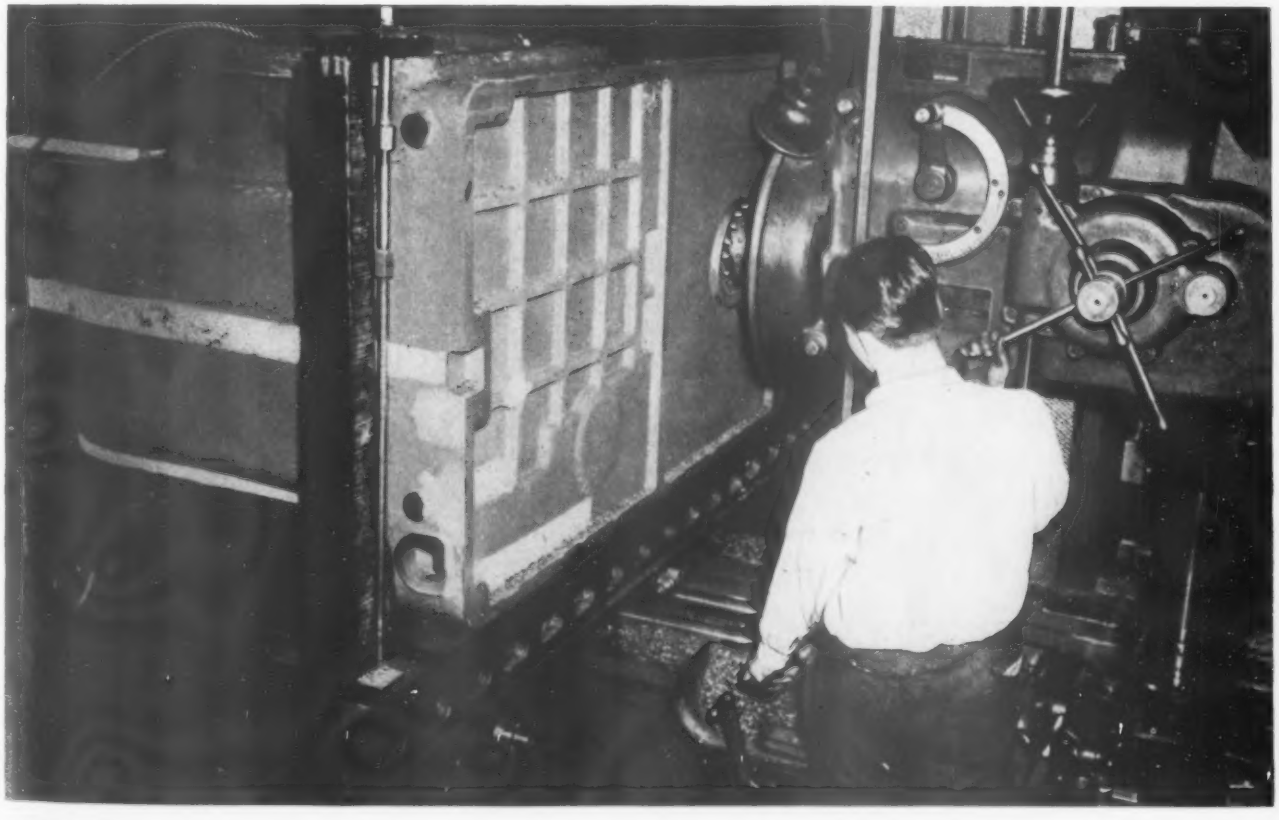
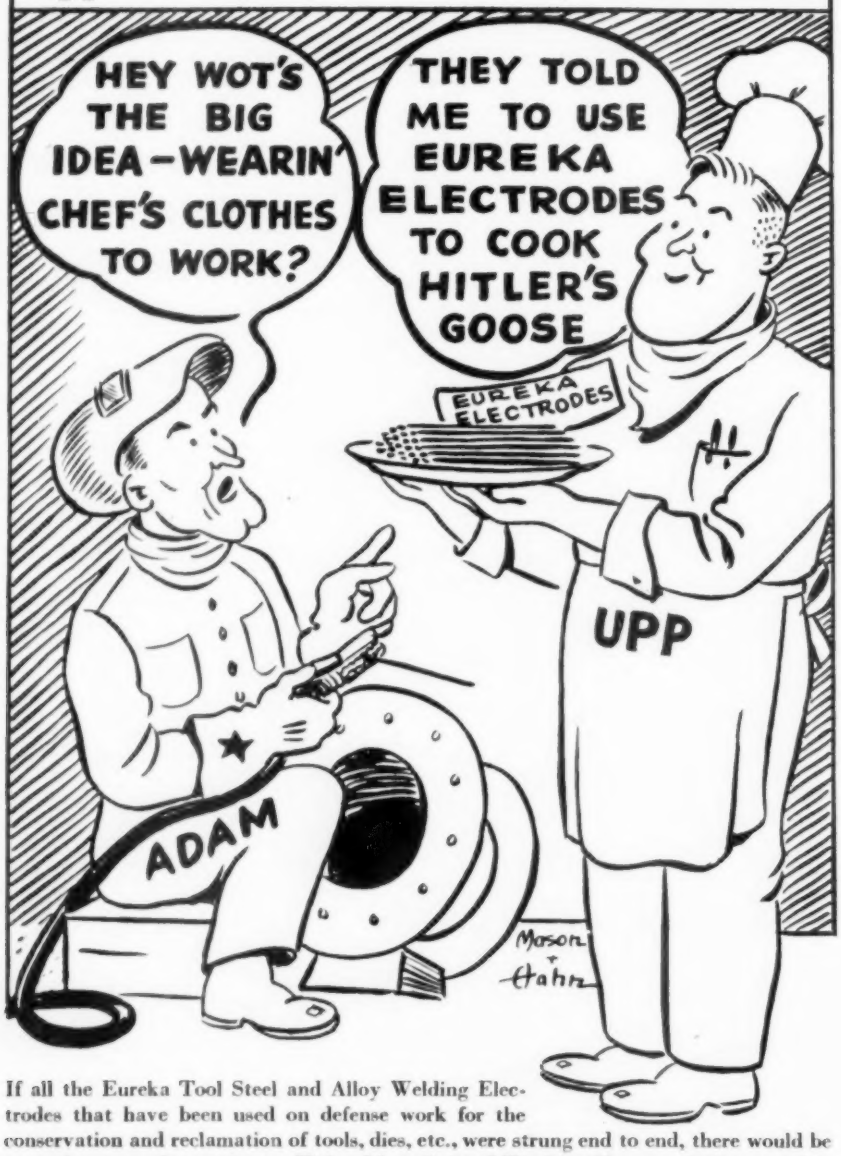


Upp and Adam — by Mason & Hahn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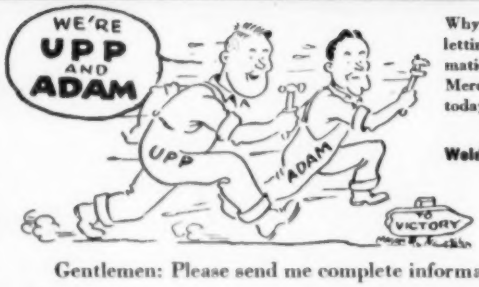

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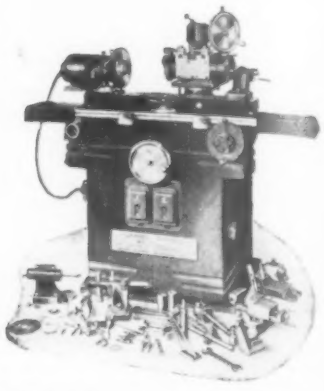

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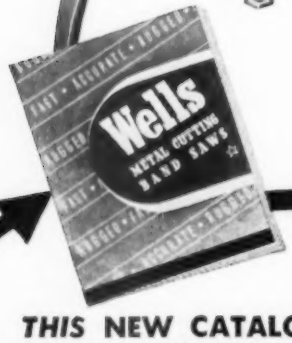

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(spec. bowed guides)	5" x 24"	(spec. bowed guides)	
Rounds	8" dia.	Rounds	5" dia.
Speeds: ft. per min.	60, 90, 130	Speeds: ft. per min.	60, 90, 130
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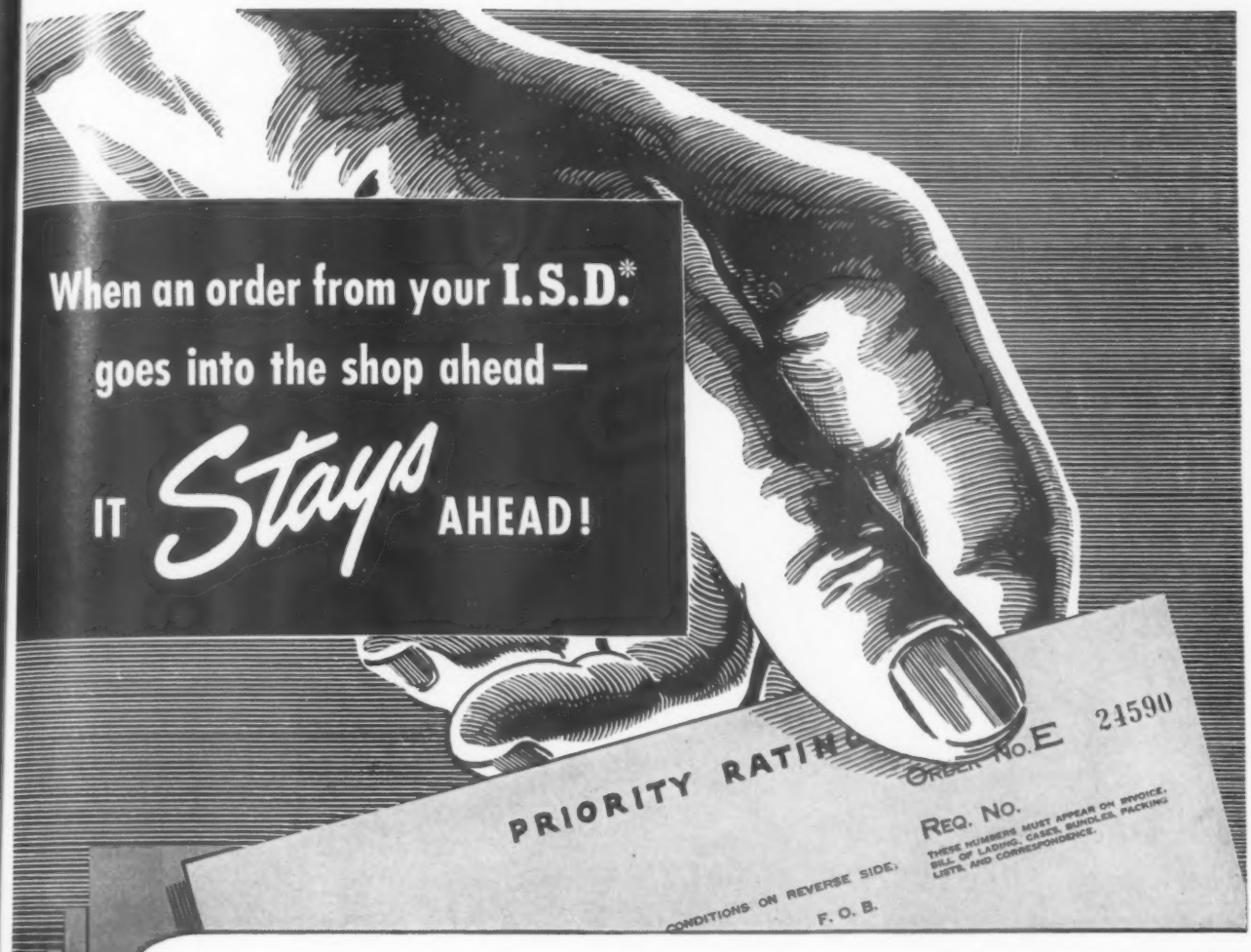
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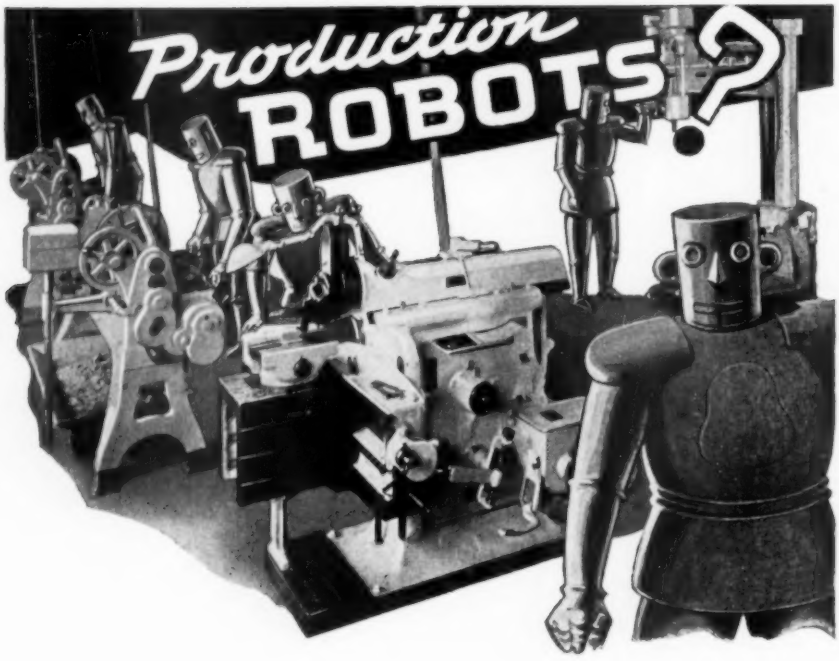

NO! the day when mechanical men will operate machines is far distant and is not to be desired until all will profit from such progress.

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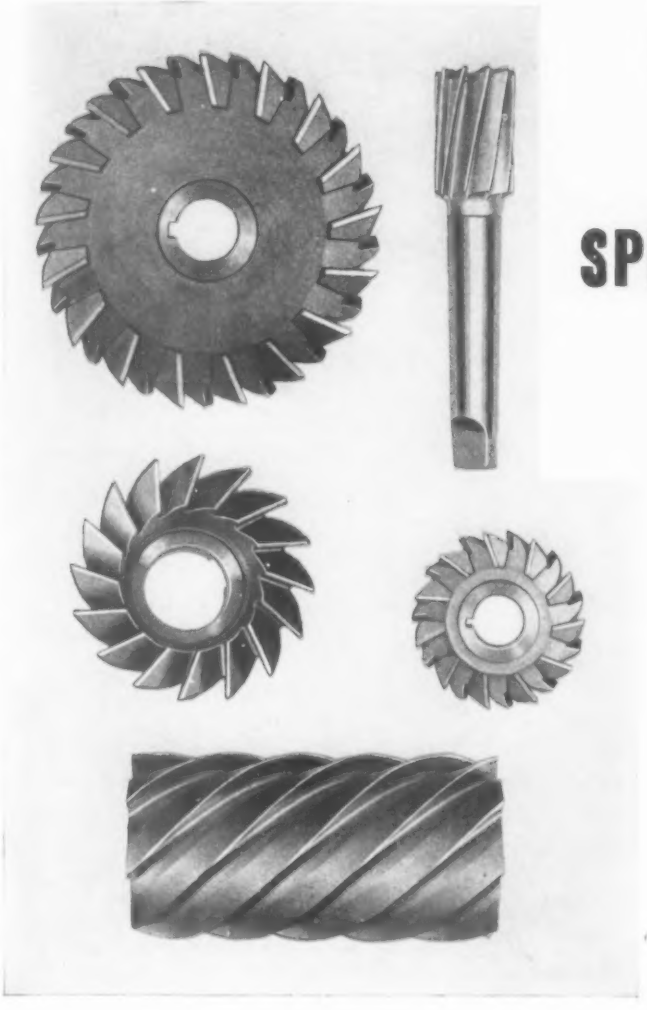

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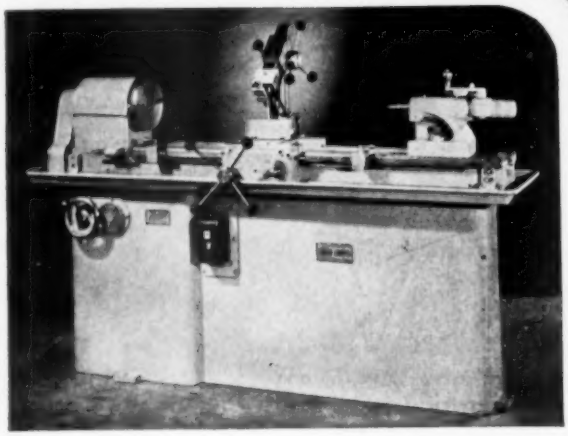

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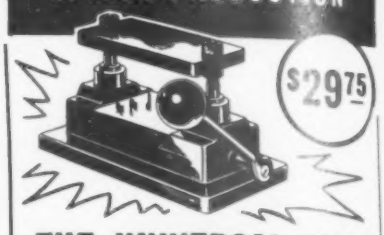

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This new book contains 30 pages cataloging all of the standard cemented-carbide tipped tools and describing many of the special tools manufactured by Carbide Fabricators. An additional 24 pages is a compilation from a number of authoritative sources of engineering data most useful to users of carbide tools.

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Made To Fit Any Machine

Furnished with male or female taper, straight, threaded or special shanks to fit any machine used for tapping or reaming.

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One of the most common causes of inaccuracies in tapping and reaming is faulty set-up or spindle misalignment which causes oversize or bell-mouthed holes. Fortunately, however, there is a simple way of eliminating this trouble. The remedy lies in using a special type of tool holder—the Ziegler Roller-Drive that compensates for spindle misadjustment. Inaccuracies in set-up are automatically overcome, making it possible to turn out work to the finest of tolerances. Investigate! It may be the solution to your production problem.

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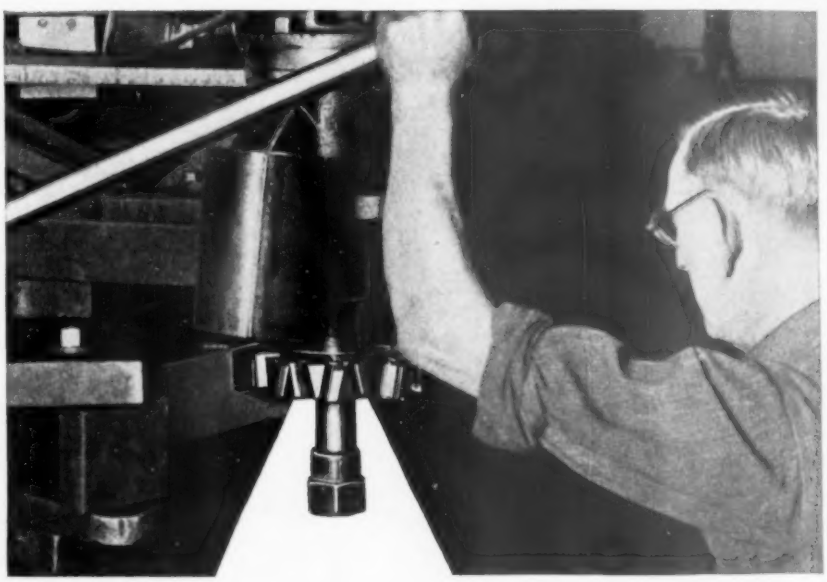

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SYSTEM
OF INSERTED-BLADE METAL CUTTING TOOLS

AUTOMATIC MILLING FOR PRODUCTION

Do You Want to Mill Contours on Many Small Parts at One Time?

The four-spindle machine shown here was one of several engineered and built by LeMaire to perform milling operations usually done on profilers, which provide a tracer roller for following model. It was developed to mill the recess for carbide inserts in tool bits, embodying a principle which was incorporated in scores of other machines to meet various specific requirements—all in small arms and aircraft milling—and all showing great increases in production over former methods. Some of the machines are milling slots in rear of carbine barrel in trigger housing, a number are milling bosses on aircraft cylinders.

The cooling fins surrounding the bosses prevent cutter from running through to clear the work. The combined use of hydraulics and profile cams makes possible the milling of odd-shaped contours in small parts with the added advantage of full automatic feeds. Since each job presents its own unique problems, LeMaire engineers suggest you send them your blue prints for analysis and solution.

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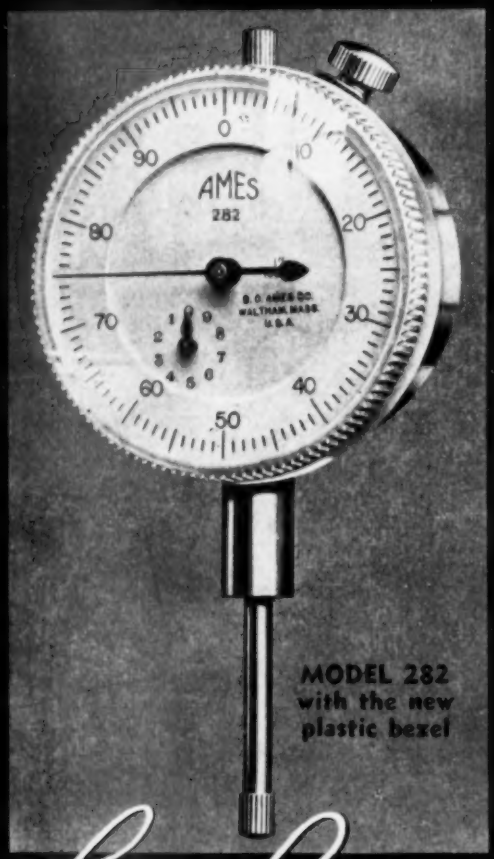

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The Plastic Bezel eliminates shadows and relieves eye strain. A new feature exclusive with AMES.

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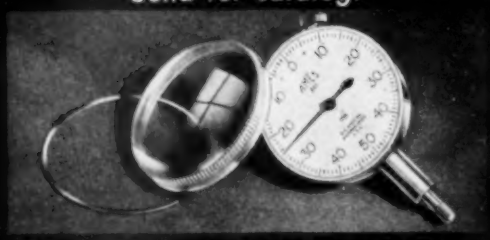

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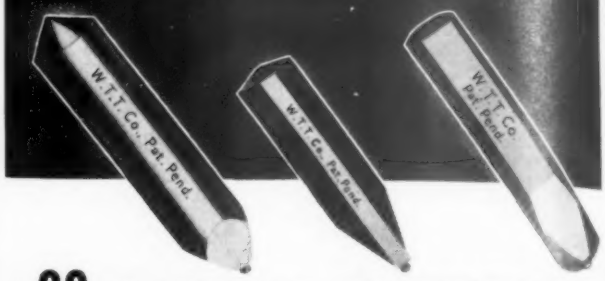
EXPERIENCE
is a Great Teacher!



33 YEARS OF EXPERIENCE
backs the development of this
NEW TYPE THREAD GRINDING DIAMOND TOOL!

Here is a new type wheel dressing diamond tool that brings new standards of performance and economy to your thread grinding operations.

It gives better performance because it utilizes the hard characteristics of the natural uncut diamond —and yet it is of a shape that permits not only straight dressing but angle, radial and multiple form dressing as well.

It gives greater economy because its cleaner cuts mean forms are obtained quicker and hold longer—fewer dressings are needed—more work can be ground between dressings—down time is greatly reduced—and because this precision tool can be made and reserviced on a production basis, quicker deliveries are assured.

And your assurance of satisfaction is the knowledge that back of this new type thread grinding diamond tool is the experience gained by a manufacturer who has spent the past 33 years building diamond tools of fine quality.

Try it and you'll agree . . .
there is no substitute for experience!

* * *

For use on

EX-CELL-O • JONES & LAMSON • DALZEN
And All Other Thread and Radius Machines

For Forming Wheels That Grind
WHITWORTH • BUTTRESS • ACME
And Any Other Special or Standard Thread

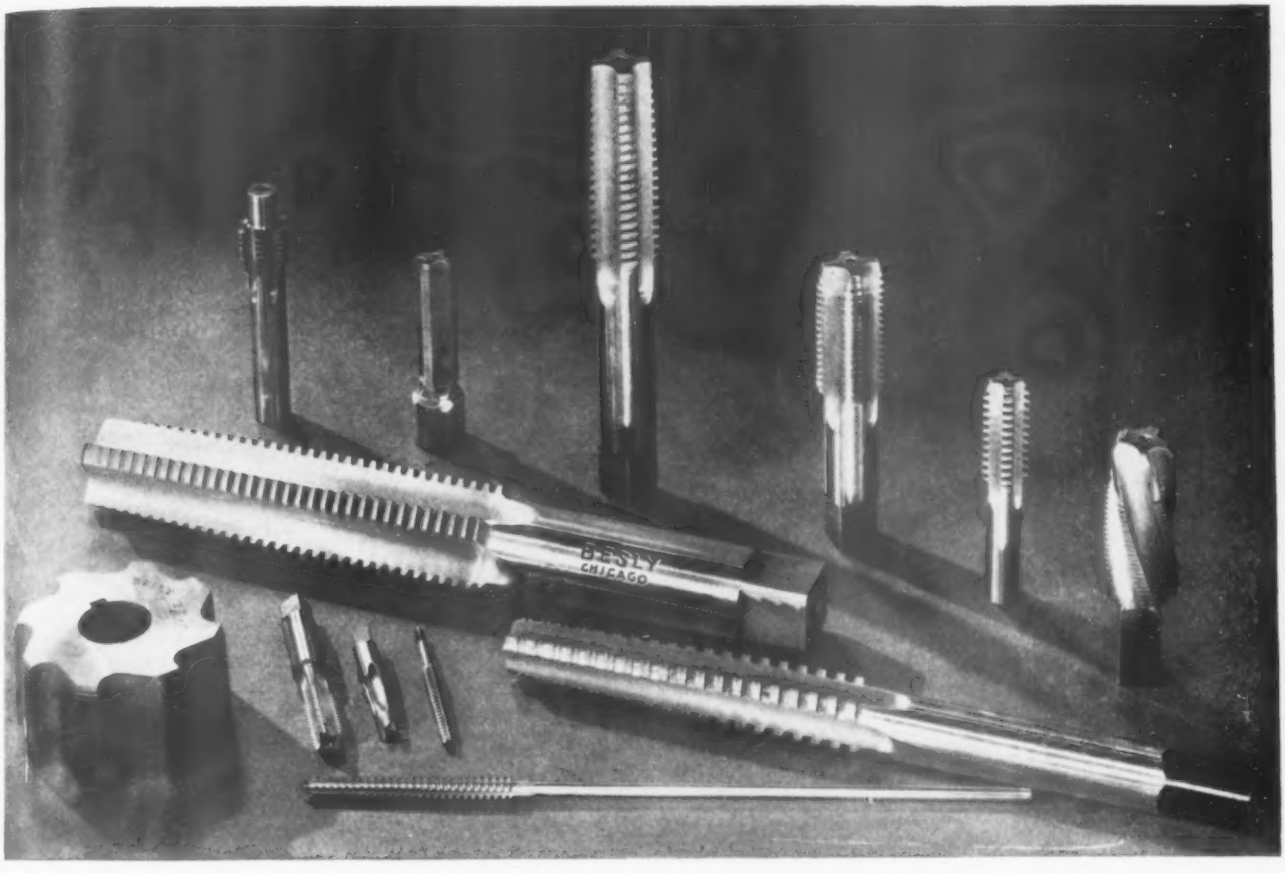
Available Only from

WHEEL TRUEING TOOL COMPANY
3200 W. DAVISON • DETROIT, MICHIGAN

Besly don't make all the good taps produced today, But

Besly Taps are all good Taps. Every step of our manufacturing process is closely watched to the end that Taps bearing the name "Besly" perform as they should.

When you think of tapping remember that Besly Taps will give you satisfactory, trouble-free production.



Send for CATALOG No. 67

It has a wealth of useful information for Tap users

CHARLES H. BESLY & COMPANY

118-124 NORTH CLINTON STREET • CHICAGO, ILLINOIS

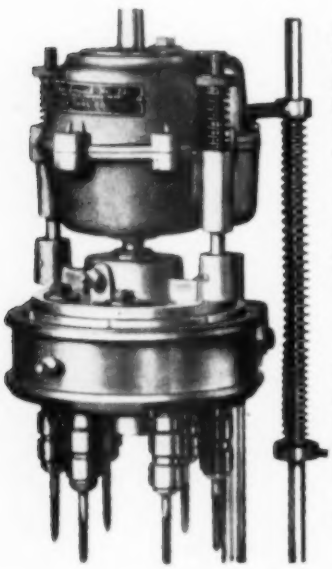
FACTORY: BELOIT, WISCONSIN

THE Ettco-Emrick SYSTEM OF MULTIPLE SPINDLE HEADS

Your key to MAXIMUM production on Drilling or Tapping

Note that word "system". It means that when you order an Ettco-Emrick Multiple Spindle Drilling or Tapping Head you get much more than just a piece of equipment.

You get a Head that has been engineered to fit the **method of handling** which will give you **maximum** production in drilling or tapping the specific part for which the Head is ordered.



A typical Ettco-Emrick Multiple Tapping Head for tapping 6 holes simultaneously. A Quill Clamp is supplied with every Head to assure the rigidity needed for high precision work. The same gear case assembly is used for drilling the holes.

In addition you get working drawings of the **holding fixture** in which the specific part can be **quickly and accurately set up** and **progressively fed** for the drilling or tapping operations.

In short, The Ettco-Emrick System assures you of **maximum** production because it satisfies every requirement for maximum production.

RANGE OF THE SYSTEM

The System covers high speed drilling of holes from wire sizes to ½" inclusive and tapping of holes from machine screw sizes up to 5/16" inclusive using our centralized driving and reversing mechanism.

DETAILS OF THE SYSTEM

Space does not permit giving details here. But they are all covered in BULLETIN No. 3. A copy of this Bulletin will be mailed to you on request. Write for it today.

ETTCO TOOL CO.

586 Johnson Ave., Brooklyn, N. Y.

Detroit • Chicago

The Famous Ettco-Emrick DRILL CHUCKS • TAP HOLDING CHUCKS
TAPPING ATTACHMENTS • TAPPING MACHINES
MULTIPLE SPINDLE TAPPING AND DRILLING HEADS
Unexcelled for Design, Materials and Workmanship

I can set up FAST with these ALCO DIE HOLDERS

The self-aligning feature of Alco Die Holders is pointing the way for wise manufacturers to cut costs by reducing set-up time. Only three things to do . . . tighten die in die cap . . . run die slowly on work for correct alignment . . . tighten two studs in the flange and start production.

And don't overlook the lowly button die . . . it's simple but efficient when used in the Alco Button Die Holder.

PROMPT SHIPMENTS NOW ON BOTH TYPES

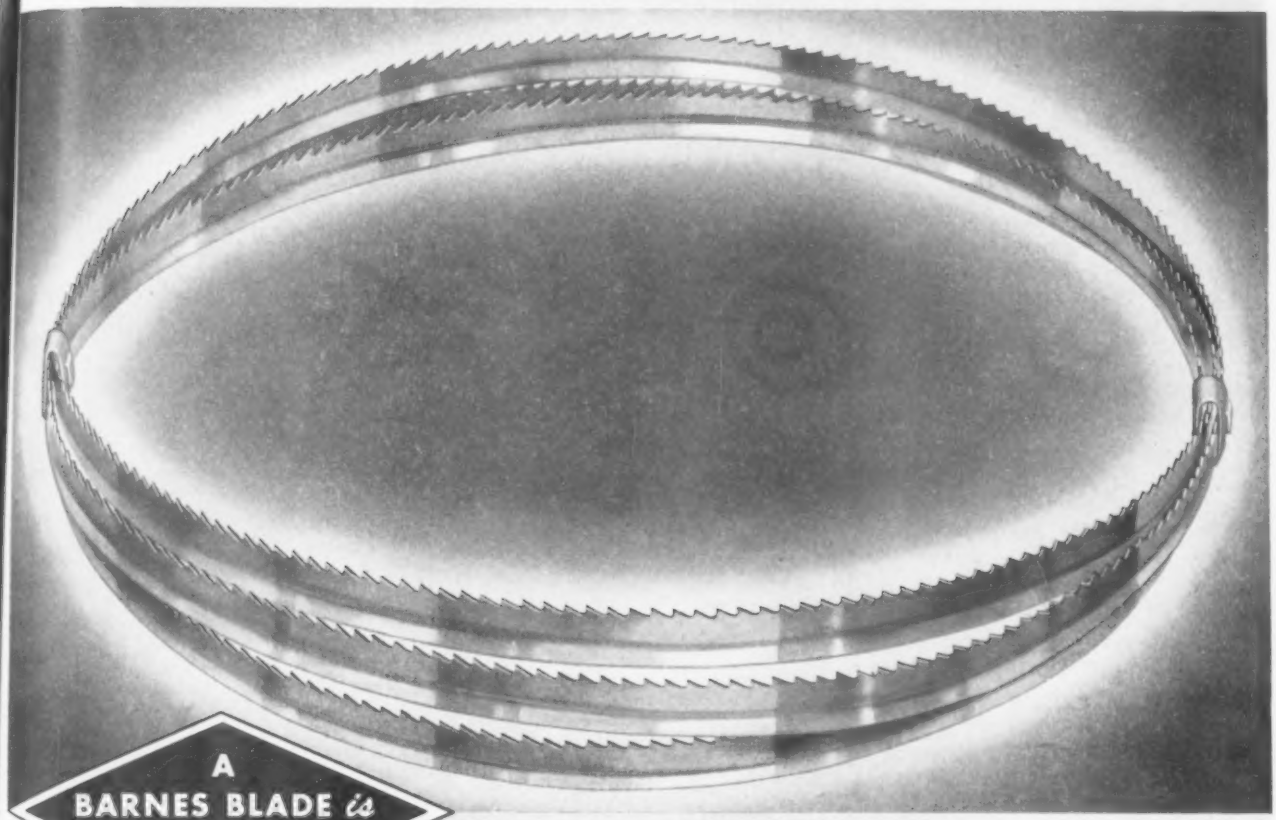
ALCO EFFICIENT TOOLS

THE ALCO TOOL CO.

453 Birdseye St., Bridgeport, Conn. • Detroit Office: 908 Stephenson Bldg.

BARNES

Where Quality is Never an Absentee!



A BARNES BLADE *is* BETTER

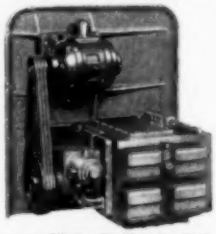
You may worry about your manpower. But you'll never worry about blade quality if the word BARNES is on the box! You get maximum productive efficiency from *every* Barnes hack saw blade and band saw you buy. Order from your distributor.

W. O. BARNES CO. INC.
DETROIT MICHIGAN

Before your new machine designs go into the shop...

CHECK THE ADVANTAGES OF HYDRAULIC UNITS LIKE THESE

When designing, or redesigning, your machines, obtain the advantages of hydraulic actuation by simply applying Barnes Complete Unit-Type Hydraulic Structures. Any combination of feed, traverse, clamping, indexing, etc. that you need comes in compact self-contained units or panels ready to install.



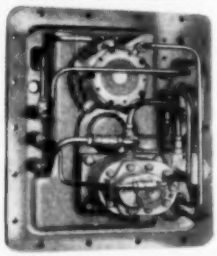
Compact Hydraulic Unit for Rifle Chambering Machine

COMPLETE CIRCUITS FROM ONE SOURCE There is no need for securing pumps, valves and cylinders from various sources. Barnes complete circuits are designed and built from standard hydraulic elements — pumps, valves, etc. All elements come from one source — eliminating divided responsibility for the performance of your machine.

Complete Hydraulic Unit for Special Purpose Machine

TWO TYPES AVAILABLE

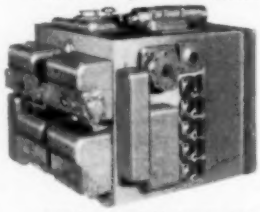
You can obtain the proper hydraulic functions for your machine from either a Barnes Self-Contained Hydraulic Unit or a Barnes Panel Unit. The Self-Contained Unit is furnished complete ready for easy installation while the Panel Unit is similar except that provision must be made in machine for oil reservoir and motor mounting.



Panel Unit complete except for tank which is integral with machine

FREE DATA!

40 page booklet contains detail descriptions of Barnes Hydraulic elements and typical installation circuits. Write for your copy today. Ask for Bulletin T.E. 643.

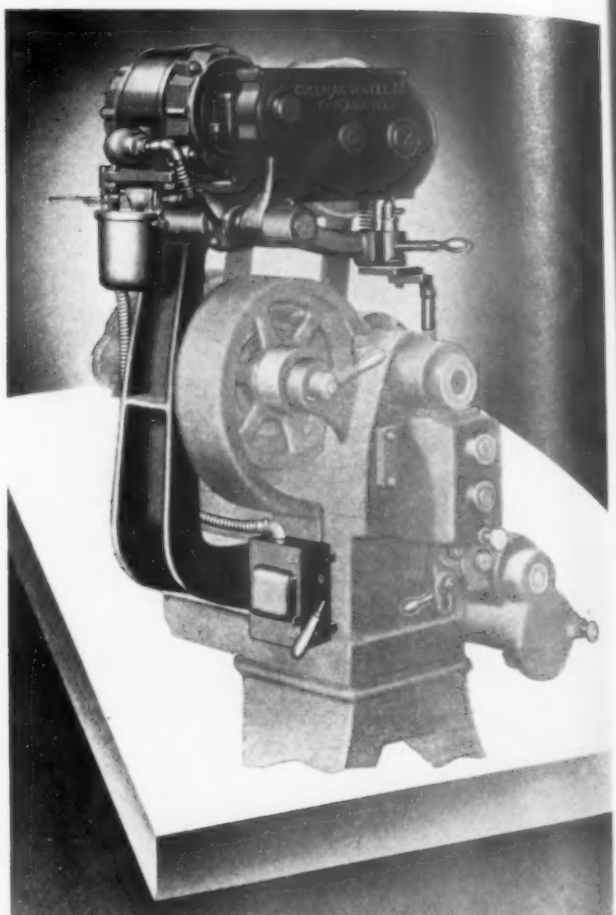


Self-Contained Hydraulic Unit Complete with Pumps, Valves and Tank

John S. Barnes Corporation

DETROIT SALES OFFICE
503 NEW CENTER BLDG.
TR-1-1706

MAIN OFFICE AND FACTORY
ROCKFORD, ILL.



Get 25% More Output from the Machines You Have with CULLMAN DRIVES

Cullman Drives will modernize shaft and belt driven lathes, screw machines, shapers, and similar equipment to give an increased output of more than 25%.

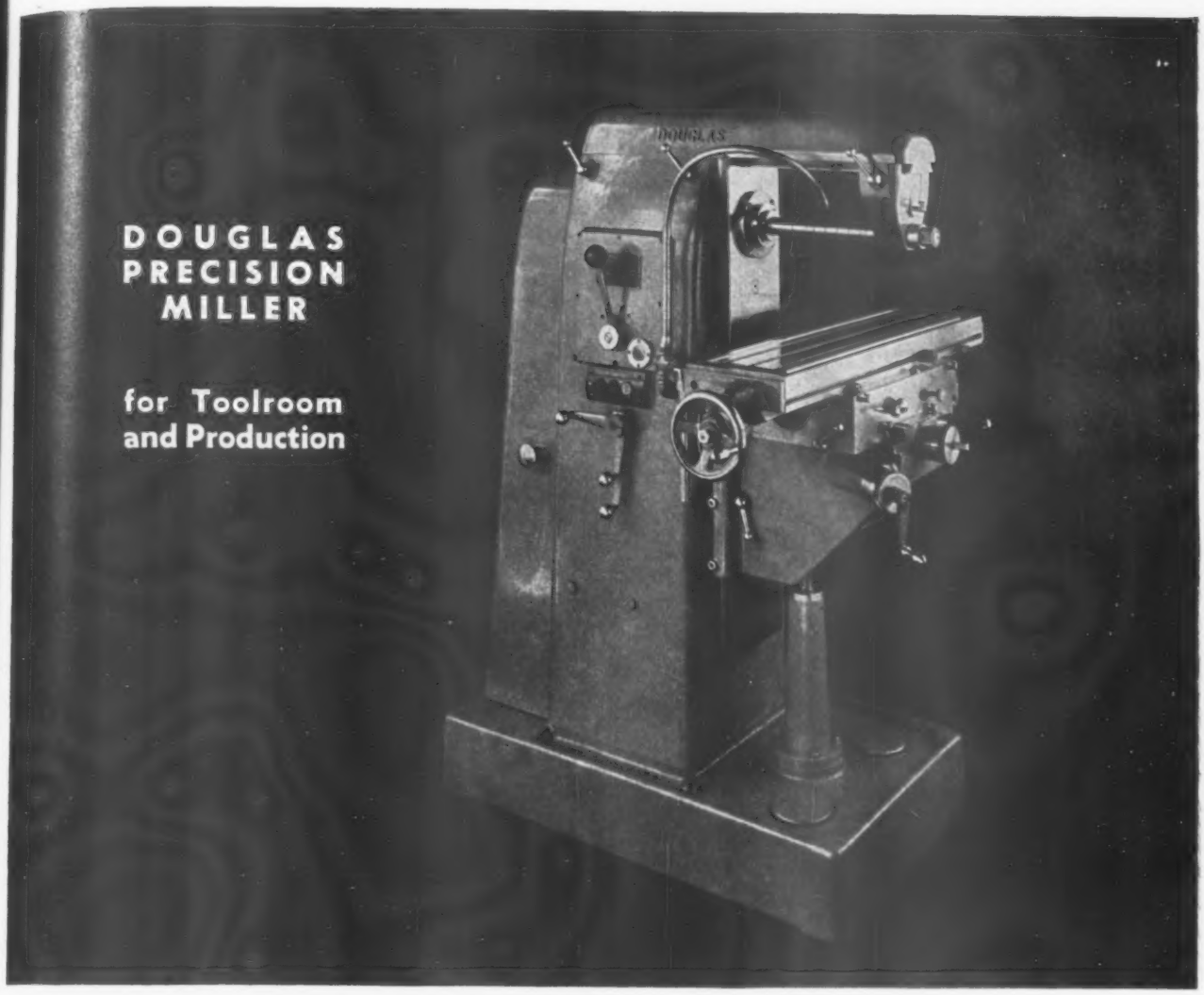
Cullman Drives give individual machine control, have greater flexibility, and are safer in operation than overhead line shaft drives. They permit the utmost in efficient arrangement for work flow and lighting.

Cullman Drives are sturdy and built for long life. They operate with belt-drive smoothness. They are easy to install and economical to buy. They are built for motors from ¼ to 15 H. P. Prompt delivery can be made on most sizes.

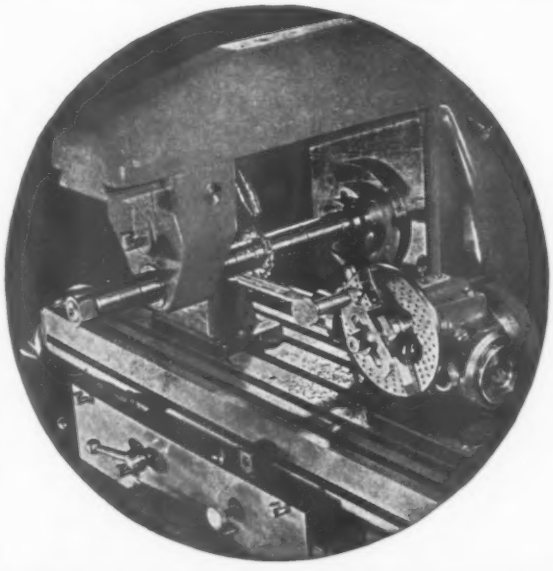
Write for full information on Cullman Drives and the 60 day trial plan.

CULLMAN WHEEL COMPANY

1352-R ALTGELD STREET CHICAGO, ILLINOIS



THE PRECISION BUILT INTO THE DOUGLAS MILLER



provides efficiency and speed to produce small parts requiring the extreme accuracy essential for war production.

Simplified design and rigid construction as well as central control make for easy operation and permit the release of highly skilled labor for other tasks.

A wide selection of speeds meets all requirements for toolroom and production.

There is an ample variety of feeds from which to choose the right feed for material and accuracy requirements.

Timken bearings and helical drive gears are other features to assure a smooth performance. Write today for specifications and prices.

PROMPT DELIVERY
TO WAR PLANTS

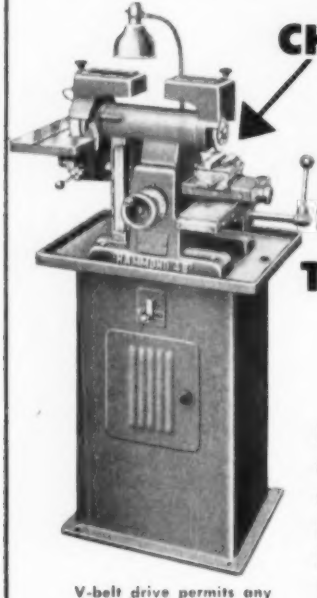
DOUGLAS MACHINERY CO., Inc.
150 BROADWAY NEW YORK, N. Y.

GRIND CHIP BREAKER GROOVES FAST AND ACCURATELY

WITH A

Hammond

CHIP BREAKER GRINDER DESIGNED SPECIFICALLY TO DO JUST THAT!



V-belt drive permits any electrical specifications

Do you tie up millers or surface grinders for carbide tool grinding jobs? Don't do it! . . . Investigate the new Hamond 4-B . . . built specifically to grind chip breaker grooves easier, faster, better. Write today for BULLETIN 201 which shows how you can get *complete* and *proper* carbide tool maintenance.

CHECK BULLETINS DESIRED, AND RETURN

- ☐ Chip Breaker Grinders
- ☐ Carbide Tool Grinders
- ☐ General Purpose Grinder
- ☐ Heavy Duty Grinders
- ☐ Abrasive Belt Grinders
- ☐ Automatic Polishers
- ☐ Cylindrical Polishers
- ☐ Polishing Lathes

Hammond Machinery Builders INC.

KALAMAZOO • MICHIGAN

1636 DOUGLAS AVENUE

Eastern Branch—71 West 23rd Street, New York, N. Y.

MARVEL SAWS

In constant service 48 hours per week at the Gould & Eberhardt plant, Irvington, N. J.

Purchased by Gould & Eberhardt, Irvington, N. J., manufacturers of gear cutting machines and shapers, to speed up cutting-off from bar stock on various grades of steel up to 6" in diameter, this MARVEL 6A high speed Production Saw has been operating 48 hours per week since installation over a year ago. When photographed it was automatically cutting identical lengths from "Maxwell" No. 3½ hot rolled natural steel 2⅝" diameter. The actual cutting time per piece, using a 6 tooth MARVEL High-Speed-Edge Hack Saw Blade, was 1 minute 15 seconds per piece.

Buy from your local distributor

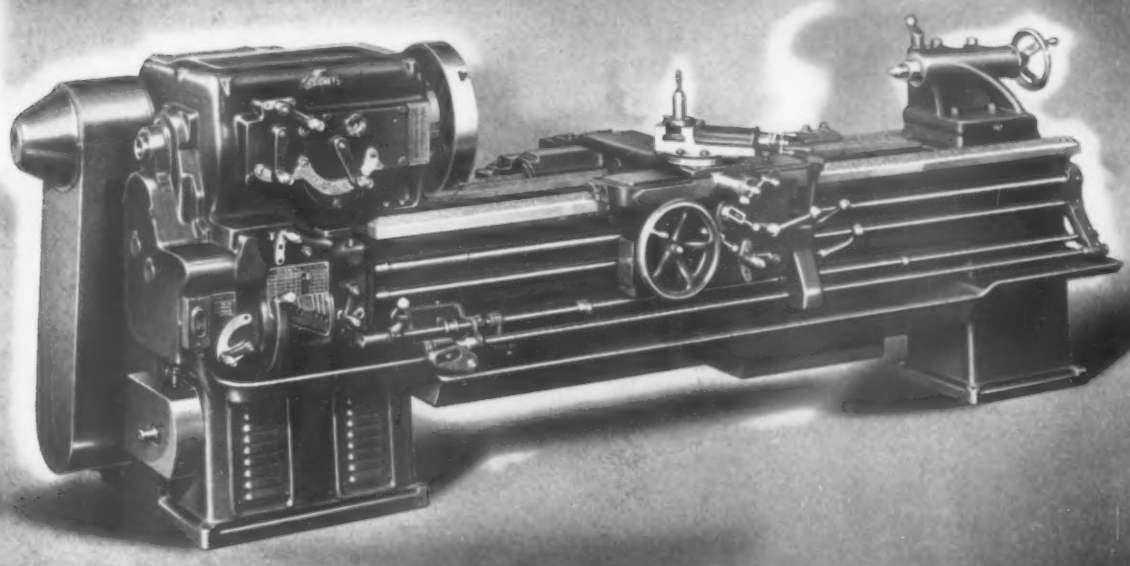
ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 Bloomingdale Ave., Chicago, U. S. A.

Eastern Sales Office: 225 Lafayette St., New York

Fire-Power on the Home Front



● Fire-Power in terms of Sidney Lathes is measured in smooth flow of power—stamina to take high speeds and heavy feeds—rigidity to maintain continued accuracy over 24 hour periods, month after month.

Such features as continuous tooth herring-bone geared head—center support for spindle and intermediate shaft in headstock—bed design that includes four walls and cross girts on twelve inch centers—spindle speed changes through internal and external gear tooth clutches are a few of the basic points of design and construction that permit Sidney Lathes to produce better work—more of it—over long periods.

Also the spindle center on the 18-20 inch lathe is only 42 inches from the floor—more convenient and less tiresome for the operator.

Full descriptive bulletin available—write.

SIDNEY
THE SIDNEY MACHINE TOOL CO., SIDNEY, OHIO, U.S.A.
Lathes

The SIDNEY MACHINE TOOL Company

Builders of Precision Machinery

SIDNEY ESTABLISHED 1904 OHIO

NEW EQUIPMENT, Materials, Processing

*T.M. REG. U.S. PAT. OFF.

TWELVE-SPINDLE AUTOMATIC SCREW MACHINE (K64)

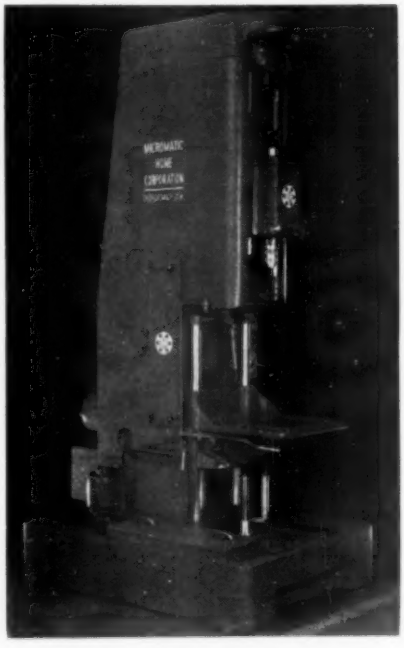
The Machine Tool Division of The C. I. Togstad Company of Kokomo, Indiana, recently announced a new 12-spindle, vertical-type automatic bar feed and chucking screw machine. This machine is hydraulically operated and is known as the Eaglesfield Verti-Matic.

The manufacturer states that this machine has been designed for fast and accurate production of parts from round, square or hexagon bar stock, and that it also may be used for the machining of drawn steel parts of different shapes. Many adaptations are claimed. For example, it is stated that the machine can be used, without changing, for chucking operations within its capacity, as the weight of the parts in the long magazine tubes automatically discharges the finished pieces.

This machine not only provides 12 different operations for finishing a part, but, according to the manufacturer, also permits duplicate operations to produce more than one part at a time when six or less operations are necessary. Thus, if a part can be made in six stages of the turret, two pieces can be made at the same time by tooling the six in duplicate.

NEW VERTICAL HONING MACHINES (K65)

A new line of vertical honing machines was recently announced by Micromatic Hone Corporation of Detroit. The machines are made in two models. The first has a capacity of from ¼ to ⅞ inch diameter work up to 12 inches long while the second model's capacity is from ⅞ to 2 inch diameter work up to 12 inches long. The maximum working stroke of both models is said to be 15 inches.



New Vertical Honing Machine
Has 15 inch working stroke.

The spindle, driven by a spline which is belt-driven, is arranged with integral, mechanically actuated reciprocation of the tool. The manufacturer also states that the entire spindle head is reciprocated on flame hardened and precision honed bars under hydraulic control with adjustable speed.

Standard manual adjustment is provided for the spindle head and an adjustment of lift-out stroke above the operating stroke.

Additional hydraulic controls include an automatic timer for cycle of spindle head movement, manual visual control of tool approach to the work, dwell control for spindle head stroke and emergency stop for spindle head movement. Electric controls comprise all push-button controls for start, stop and short stroke.

The manufacturer states that these machines are furnished with riser block tables and have ventilated columns.

INFORMATION FREE

For complete information on equipment listed in this section, list the key number preceding each item and your name and address on postcard coupons—page 163.

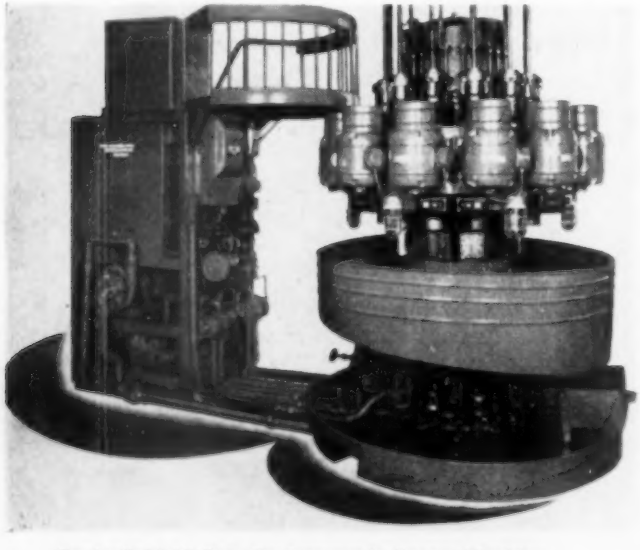
NEW INTERNAL GRINDER (K66)

Providing both hand and hydraulic table operation, a new internal grinder has been announced by Sav-Way Industries, 4879 East Eight Mile Road, Detroit. Each type of operation is independent of the other, although, the manufacturer states, it is possible to use both the hand and hydraulic feed in combination on the same job and in the same setting.

Hand operation is said to give the worker complete control for setting up. It is said to be frequently preferable for short holes, blind holes and facing. With the hydraulic system, high table speeds by power are obtainable for long holes.

Table speeds range up to 55 feet per minute. Minimum table stroke is ⅜ inch while the maximum is 24 inches. The base measures 70¼ inches by 48½ inches and the floor space required is 105 inches by 48½ inches.

(Continued on page 166)



Eaglesfield 12 Spindle Automatic Screw Machine
Duplicate operations are said to be possible.

Internal Grinder with Hand and Hydraulic Feed
Table speeds range up to 55 feet per minute.

FREE INFORMATION and SERVICE

Request the information and service you desire and keep your library up-to-date . . .

THREE FREE SERVICES without obligation

For your convenience these three business reply cards enable you to request quickly

1:
New catalogs — bulletins listed in this issue.

2:
Additional information or bulletins relative to new equipment — new materials or new processes.

3:
When answering advertisements, specific information on problems or company representative's call.

HOW TO ORDER

Simply fill out the card, indicating the information or service you desire, and mail.

Be sure to write, in the square, the identifying number of the catalogs or bulletins covering new products described.

In answering an advertisement, include the name of the advertiser and indicate by a cross if literature is desired or if company representative should call. No stamp is required.

1

USE THIS CARD

for requesting new catalogs and bulletins listed in this issue.

2

USE THIS CARD

for requesting additional information or bulletins about new equipment, materials, processes, etc.

3

USE THIS CARD

when answering advertisements, to obtain specific information on problems, or when you desire a company representative to call

---

Write in square, number of item describing one catalog wanted ➔ ☐

NAME

COMPANY

ADDRESS

TITLE

THE TOOL ENGINEER, JUNE 1943

Write in square, number of item describing one catalog wanted ➔ ☐

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USE THESE *FREE* REPLY CARDS

They are provided for your convenience in requesting information and service . . . . .

FIRST CLASS
PERMIT No. 6691
(Sec. 510, P. L. & R.)
DETROIT, MICH.

BUSINESS REPLY CARD
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

2c.-POSTAGE WILL BE PAID BY—

THE TOOL ENGINEER
THE BRAMSON PUBLISHING COMPANY
2842 W. GRAND BLVD.
DETROIT, MICHIGAN

1

Request for:
NEW CATALOGS
BULLETINS
BOOKLETS

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PERMIT No. 6691
(Sec. 510, P. L. & R.)
DETROIT, MICH.

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Request for additional information and catalogs covering
NEW EQUIPMENT
MATERIALS
PROCESSES

FIRST CLASS
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(Sec. 510, P. L. & R.)
DETROIT, MICH.

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3

ANSWERING ADVERTISEMENTS
Requesting:
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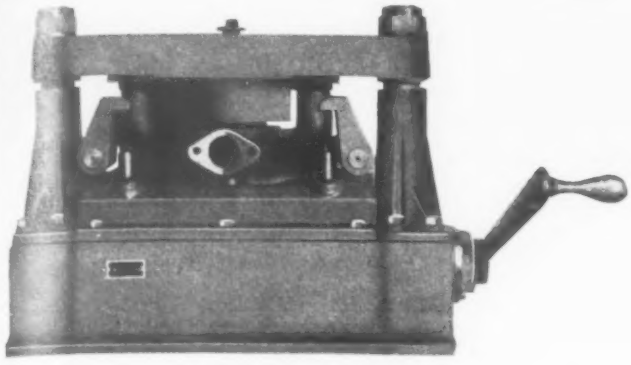
REPRESENTATIVE TO CALL



PROPOSAL L-878

Heavy duty built up type fixture drilling manifold. All locating, chucking and clamping is done by the movement of operating lever.

DESIGNERS

BUILDERS

ALL TYPES OF SHOP PRODUCTION TOOLS

STANDARD FIXTURES AND FIXTURE LOCKS

SWARTZ TOOL PRODUCTS CO., INC.

13330 Foley — ASK FOR CATALOG 941 — Detroit, Michigan

Represented by

Cleveland—J. W. Mull, Jr.
Indianapolis—J. W. Mull, Jr.
Milwaukee—Geo. M. Wolff, Inc.
Houston—Engineering Sales Co.
Chicago—Ernie Johnson

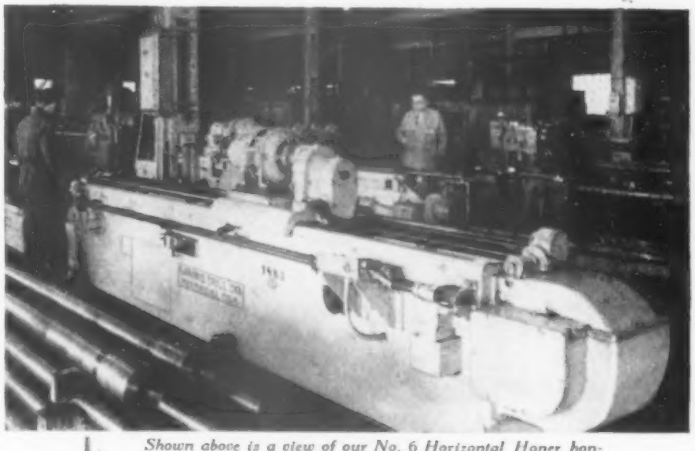
Canada—Hi-Speed Tools, Ltd., Galt, Ont.
St. Louis—Mill Supply & Mach. Co.
Los Angeles, Calif.—Production Tool Engineering

Oneida, N. Y.—W. F. Himmelsbach
Pittsburgh—J. W. Mull, Jr.
Toledo—J. W. Mull, Jr.
Philadelphia, Pa.—Morgan Tool & Equipment Co.

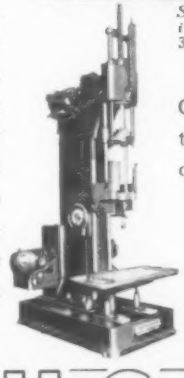
HOW BARNESDRIL HONERS GIVE GREATER ACCURACY and SMOOTHER FINISH

ON ALL CYLINDER BORES

IF YOU have a production problem involving the finishing of cylinder bores, BARNESDRIL Honing Machines will give you greater accuracy, smoother finish and higher production than can be attained by any other known process. Proper honing gives you desired surface finish. All defects of previous commercial operations, such as tool marks, hills and valleys, grinder marks, etc., are removed. The right BARNESDRIL Honing Machine for the job with the proper tools will provide the final accuracy of both roundness and straightness of the bore and final dimensional size accuracy within 0.0005″ to 0.0002″ tolerances. Whatever your finishing requirements, there's a BARNESDRIL Honer for the job. They are made in vertical, horizontal, and angular types, with one or more spindles.



Shown above is a view of our No. 6 Horizontal Honer honing bores of anti-aircraft gun barrels. To the left is our No. 307 Standard Honing machine . . . adaptable to many jobs.



HELP ON YOUR HONING PROBLEMS

Our engineers will be glad to recommend the proper type and model honer for your specific production requirements. No obligation.

FREE HONING DATA

Here's a valuable booklet with complete details of the honing process and our entire line. Write for free copy of Bulletin T.

848-71 CHESTNUT STREET

Barnes Drill Co. ROCKFORD ILLINOIS, U.S.A.

MULTIPLE INSPECTION GAGE (K67)

The Model 247 B-76 gage is one of several multiple inspection gages recently announced by Federal Products Corporation of Providence, R. I. These gages check several diameters simultaneously and thus are said to speed up inspection. They are entirely mechanical and do not require electrical connections.

The Model 247 B-76 gage is designed to check, in one operation, five entirely separate dimensions on a fuse body. The gage stands upright so that the dials will face the operator as he sits at his bench.

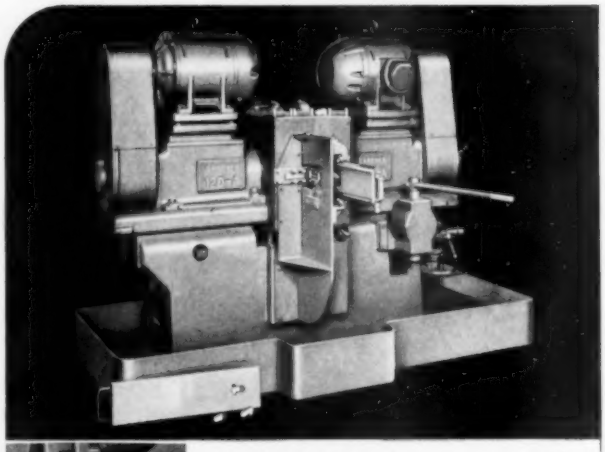
The gage must be first set to a master. The fuse body is positioned in the gage by placing it on three supporting blocks. The movement of each sensitive contact is transmitted to each dial indicator point through a pantograph unit. This feature is said to prevent the dial indicator points from becoming worn or damaged by constant contact with the work being gaged.

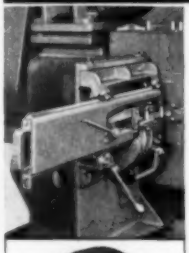
The above described gage is used for gaging thickness, height and distance. Another multiple inspection gage checks the various diameters of a rotor shaft. The third new gage checks simultaneously eight diameters and two lengths on a cylindrical sleeve.

INFORMATION FREE

For complete information on equipment listed in this section, list the key number preceding each item and your name and address on postcard coupons—page 163.

"Back-to-back" grinding
on this
GARDNER DOUBLE GRINDER





A *Modern* GARDNER WIRE-LOKT ABRASIVE

IN CONTRAST to the customary parallel-surface work generally handled on Gardner Double Grinders, here is an unusual fixturing job which enables ONE surface of TWO duplicate parts, to be ground in one setting.

Carriage clamps, made of steel, are ground on this No. 120A-20" Gardner Grinder in a roller gun-type sliding fixture. A piece is carried in each side of a double fixture, giving a "back-to-back" arrangement, and a locating guide and hand-operated clamping mechanism, fixtures the parts quickly.

PRODUCTION: 2 to 4 pieces per minute, with the ground pads held within .005" for size.

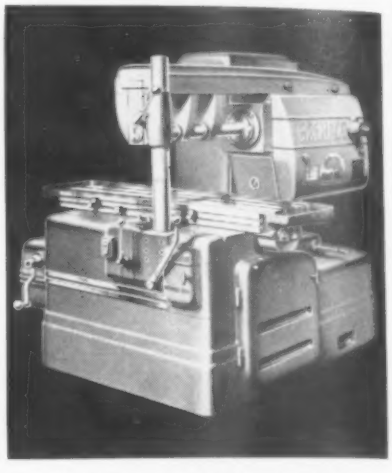
Ask for data on this GARDNER DOUBLE GRINDER

GARDNER MACHINE COMPANY
442 East Gardner Street » » » » Beloit, Wisconsin, U. S. A.

MILLING MACHINE (K68)

The new milling machine recently announced by the Bremacc Corporation of Detroit is equipped with twin lead screws and is said to be capable of down cut milling on a precision, high speed production basis.

Called Model 4, this new machine uses two unsplined lead screws that are so connected in relation to each other that the effective bearing surface, with the feed nut, is constantly in tension through the use of a synchronizer sleeve.



New Bremacc Milling Machine
Equipped with twin lead screws.

The table feeds range from ½ to 30 inches per minute. Rapid traverse has a standard table movement of 125 inches per minute. Both table feeds and rapid traverse can be operated manually or automatically in either direction.

The manufacturer states that the accuracy of the plane of travel of the work table is provided for by two conventional dovetail ways. The rear slide is securely mounted and permanently fixed, while cross adjustment of the front slide is accomplished by means of adjusting screws without removal of the table. It is stated that this method avoids the necessity of taper gibbing.

NEW ROUGH METAL FINISH (K69)

A new war time rough metal finish called Pebble-tex was recently announced by The Egyptian Lacquer Manufacturing Company of New York. The manufacturer states that the new finish has been used by builders of parts for military radio equipment, for instrument panels, fire control and listening devices and other service items requiring a texture high speed metal finish.

For full protection, it is recommended that this finish be applied over a primer. However, the pattern may be obtained with a single application on the bare metal. It is said that both rough and fine texture and varying de-

(Continued on page 168)

RECOMMENDED PROCEDURE

1. MACHINE END FACE
2. DRILL HOLE
3. BROACH HOLE
4. FINISH END FACE AND CONTOUR LOCATING FROM BROACHED HOLE

COMMON PROCEDURE

1. MACHINE END FACE
2. DRILL HOLE
3. MACHINE CONTOUR LOCATING FROM DRILLED HOLE
4. BROACH HOLE

How to get more accuracy by Broaching

5. BY PROPER MACHINING SEQUENCE.

THE drawing used at the left illustrates a broaching principle.

To get the most out of broaching—don't expect a broach to correct eccentricities or lack of squareness created by previous machining sequence. Broach your holes and surfaces FIRST and then use these surfaces to locate from.

This is one of the "Do's and Don't's on Broaching" available in printed form in bulletin board size. Write for a copy today. Ask for Bulletin No. 274.

colonial BROACH COMPANY

Broaching Machines *Broaches-Broaching Equipment*

DETROIT . . . . . U. S. A.

grees in between may be obtained from the same mix by gun adjustment and application technique. Pebble-tex is available in a variety of colors.

UNIVERSAL VISE (K70)

The universal precision machine tool vise for angle milling, drilling, grinding and boring is built by the Wesson Company of Detroit. The manufacturer states that it may be mounted on any machine tool for any angle machining operations.

Mounted by T bolts to machine, the vise is said to be portable and may be moved from one machine to another without disturbing the angle or removing the work. The vise swings through 180 degrees in the top plane, 90 degrees in the vertical plane and 360 degrees in the bottom plane.

The Wesson vise is made in two sizes. No. 1 has a jaw opening up to 4 inches and is 6⅛ inches high. The No. 2 has a jaw opening up to 1⅛ inches and is 4⅜ inches high. Both may be equipped with angle plates.

Freedom from chatter and ability to handle heavy cuts are said to be assured through the extreme rigidity and the distinctive cradle construction of the vise.

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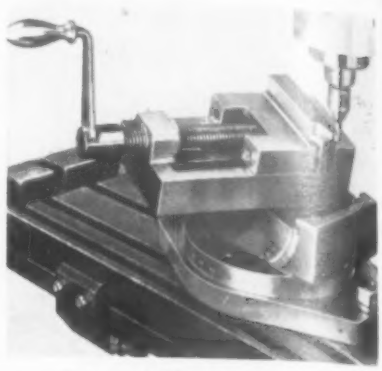
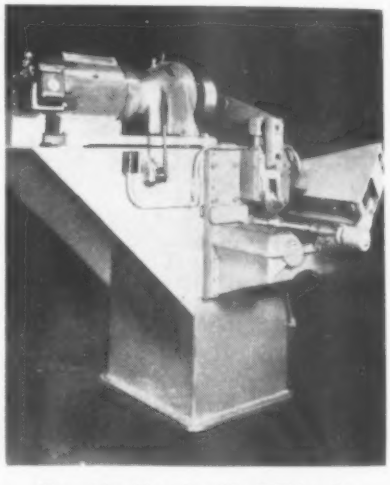


Universal Machine Tool Vise
For machining at any angle.

NEW SHELL CROPPER (K71)

A "shell trimmer" that is said to save time, shipping charges and scrap handling was recently announced by The Yoder Company of Cleveland. It was developed by this concern in collaboration with The Dresser Manufacturing Company of Bradford, Pa.

This machine trims the crop end of the shell forging while it is still hot at the forge plant and thus is said to save the shipping of the end that is cut off. It saves the operation of cold sawing this end and considerable scrap handling.



New Machine for Shell Trimming
Saves time and scrap handling.

The shell is cropped at forging temperature and the manufacturer states that the machine should be set in the forge line immediately following the final sizing operation. According to the manufacturer, shell forgings ranging in size from the 60 mm trench mortar to the 155 mm high explosive shell can be cropped.

FACING MACHINE (K72)

The new facing machine, recently developed by Morey Machinery Co.

(Continued on page 170)

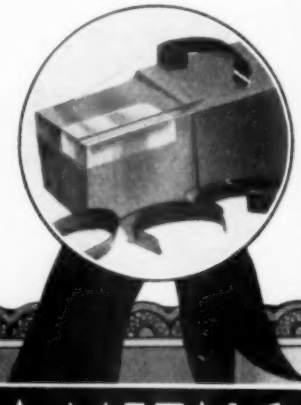
PRODUCTION INSURANCE

The installation of KENNAMETAL steel-cutting carbide tools for boring, turning, and facing operations will insure maximum steel machining production.

KENNAMETAL assures maximum production because:

1. KENNAMETAL operates at speeds equal to machine capacity.
2. KENNAMETAL cuts more steel per regrind and more steel per tool life.
3. KENNAMETAL cuts high Brinell steels at economical feeds and speeds.
4. KENNAMETAL takes jump cuts without danger of tool breakage.
5. KENNAMETAL holds size on long cuts.

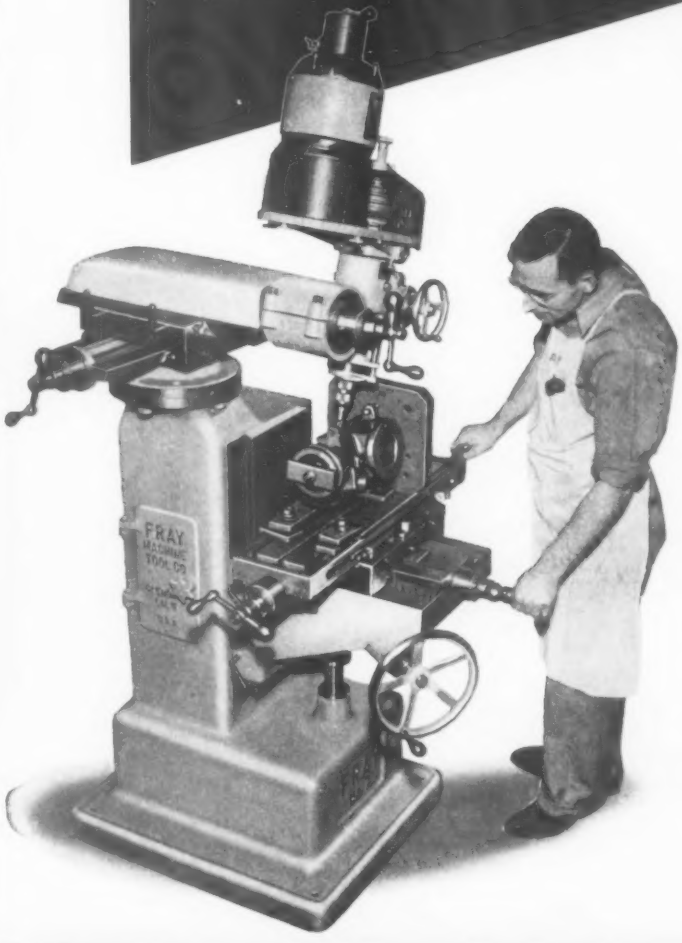
Eliminate risk and insure your production . . . use KENNAMETAL steel-cutting carbide tools.



McKENNA METALS Co.
600 LLOYD AVE., LATROBE, PA.
Foreign Sales: U. S. STEEL EXPORT CO., 30 Church St., New York
(Exclusive of Canada and Great Britain)
Trade Mark Reg. U. S. Pat. Off.

ONLY ONE WORK SET-UP for *all* operations with

Fray RAM TYPE No. 7-B UNIVERSAL MILLING MACHINES



The 10" cross movement of the ram above the work, as well as the 12" transverse movement of the ram, combined with the 360 deg. rotation of the turret head—give a range of operations with one work set-up that is *not possible* with any other milling machine.

In addition to the controlled movement of the ram and turret, the "All-Angle" milling head can be rotated 360 deg. in horizontal or vertical planes, so that the head can be instantly set to any angle or compound angle.

For positive and accurate travel, ball cranks mounted on feed screws carry 3" dials and are calibrated in one-thousandths. The table working surface measures 7½" x 29", and has a cross feed travel of 7". Table stops calibrated in one-thousandths.

These are precision tools in every sense of the word — designed by toolmakers for use by toolmakers.

Write for descriptive literature.

FRAY MACHINE TOOL CO.

505 WEST WINDSOR ROAD • GLENDALE, CALIFORNIA

Manufacturers of Fray Micrometer Offset Boring Heads, and Fray "All-Angle" Milling Attachments

Inc., 410 Broome Street, New York, is said to be particularly adapted to facing the end of long or irregular shaped pieces that would be difficult to mount on a planer.

The manufacturer states that it is especially suitable for facing spots on large castings, where, of necessity, the castings must be held stationary and the facing head brought to the spot which requires machining.

The machine has a capacity up to 46 inches in diameter. It is a self-contained motor driven unit, used with or without other duplicate heads set in a fixed position parallel at right angles, or at other angles to each other. The cutting tool used in this machine is said to be identical to that used in the engine lathe and can be easily taken out to be re-sharpened. The size of the cutting tool bit is 1 inch square.

A two-way feed is provided so that the cutting tool may be fed away from the center or toward the center. Pick-off gears are included to change the speed of the head to suit the work. The machine has four feed changes per revolution.

To illustrate a specific example of the work done by this machine, the concern states that it is being used in its own plant to face the end of bed sections of lathes, drilling machines and thread millers.

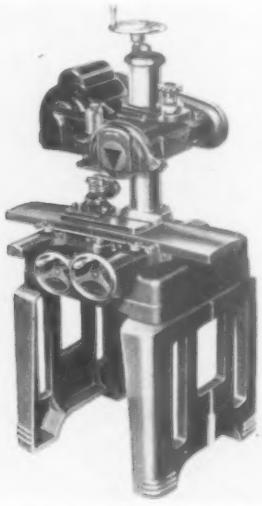
INFORMATION FREE

For complete information on equipment listed in this section, list the key number preceding each item and your name and address on postcard coupons—page 163.

CHIP BREAKER GRINDER (K73)

Designed to grind the chip-breaker groove in Carbide tipped tools, this new grinder, recently announced by the Delta Manufacturing Company of Milwaukee, can also be used for grinding form tools, thread chasers and other units which must be accurately ground, according to the manufacturer.

One of the outstanding features of this new grinder is said to be the Univise — a universal vise which holds the work at any desired angle. The manufacturer states that when the Univise is removed, the grinder can be used as a surface grinder.



New Delta Chip Breaker Grinder
Can be used as a surface grinder.

Another feature is said to be the unique wheel-mounting arrangement that utilizes a two-piece adapter, so that either wheel, or wheel and adapter, can be removed. Here the advantage is said to be that once a wheel has been trued up, it can be removed and replaced with the adapter and without any further dressing.

Specifications on this new grinder include: Maximum length that can be ground, 13½ inches; maximum width that can be ground, 6 inches; minimum diameter cup wheel with standard guard in place, 3½ inches; and maximum diameter wheel, 7 inches.

MULTIPLE SPEED PUSH BUTTON (K74)

A multiple speed push button which provides up to five speeds in a single button has recently been developed by Northern Engineering Works of Detroit. The accompanying illustration shows a battery of these buttons mounted in a pendant.

As the button is pushed in, it moves a metal cylinder to wipe over a succession of contacts. The contacts are steel balls mounted on springs, stiff

(Continued on page 172)

INVESTIGATE Tannewitz DI-SAWS and You'll Want No Other!

A broad statement? Yes. But soundly founded on facts—the experience of numerous large manufacturers—the actual performance records of the machines, themselves—and fundamental superiorities of design and construction.

Larger wheels (24" diameter on the standard models) provide greater traction, faster, straighter cutting, more production. Transmissions, common source of die saw grief, never fail in TANNEWITZ DI-SAWS. Sturdier, heavier construction throughout, plus many refinements of design, make these machines the greatest, trouble-free producers in their field. It pays to buy the best!

With a TANNEWITZ DI-SAW you can do in minutes jobs which require hours by the shaper, miller or lathe methods.

Get the complete facts. Just write for DI-SAW bulletin.

STANDARD MODEL No. M24 (24" WHEELS)

Other Models to Handle Work of Practically Any Size

Made with 30", 36", 48" and even larger throat capacities if desired, the TANNEWITZ "Big Bertha" models make available the tremendous savings of inside and outside sawing, filing and polishing on dies, jigs and other work of practically any size. Write for bulletin.

THE TANNEWITZ WORKS, GRAND RAPIDS, MICH.

Here's a machine that helps to relieve

MANPOWER SHORTAGE

SIMPLIFIED DESIGN of this modern, motor driven lathe eliminates many costly features not required for a wide variety of turret lathe work.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★

Now Equipped with Automatic Indexing Turret

Concentrate highly skilled operators on complicated machines to handle only such jobs as demand top skill. Divert a wide variety of simpler operations to the Oster No. 601 "RAPIDUCTION" Turret Lathe which does the work equally well but with less experienced operators.

That formula, simple as it sounds, has proved to be an effective solution to the growing problem of "MAN POWER SHORTAGE" of highly skilled workers who can't be "duplicated" with novices crammed with a few weeks training.

But the same "novices" CAN be brought quickly to high standards of efficiency with the Oster No. 601 "RAPIDUCTION" Lathe. This modern, motor driven machine with its six-position turret now controlled by automatic indexing is doing multiple-shift work in scores of war production plants.

We're celebrating our 50th Anniversary by helping war production plants minimize the problem of MANPOWER SHORTAGE.

The form below is a convenient way of inviting us to "celebrate" in YOUR plant.

No Time Out to Celebrate Our 50th ANNIVERSARY 1893-1943

OSTER

THE OSTER MFG. CO., 2063 E. 61st ST., CLEVELAND, OHIO, U. S. A.

★ O.K. Oster. We're interested in the No. 601 machine. ( ) Send Catalog No. 601. ( ) Ask your nearest distributor to see us at once. (Check either or both of above requests.)

NAME .....

ADDRESS .....

CITY ..... STATE .....

enough so that the operator can "feel" the successive clicks.

While this button was designed primarily for crane and hoist operation, the manufacturer states that it is easily adaptable to any machine where pilot or relay circuits are used.

INFORMATION FREE

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DRILLING MACHINE (K75)

Two important features were mentioned in the recent announcement of a new bench type drilling machine introduced by the Sigourney Tool Company of Hartford, Conn. First, as a safety feature for inexperienced operators, the new machine is designed so that all moving parts are enclosed except for the chuck and the drill. Second, extra weight and strength have been incorporated in the design to meet 24 hour operation requirements, according to the manufacturer.

Called the M-100, this new drilling machine operates at spindle speeds of 4,000, 7,000 and 10,000 rpm. The motor is held in vertical position and enclosed in the column. The drive is through three step cone pulleys with V belt.

It is claimed that flexibility in sizes of work handled is possible since the machine may be used with spacer blocks

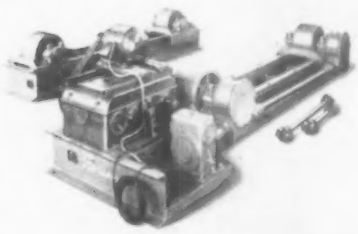
New Bench Type Drilling Machine
Single or multiple spindle design.

of various sizes inserted between column and base to give increased distance between table top and chuck.

This machine is available in single or multiple spindle design and foot treadle can also be furnished. It is equipped with sealed ball bearings throughout. Pratt & Whitney, Division Niles-Bement-Pond Company are sole sales agents for Sigourney Drills.

WELDING POSITIONER FOR CYLINDRICAL WORK (K76)

The accompanying illustration shows the turning roll set for position-welding long drums, tanks and other heavy cylindrical pieces recently announced by the Industrial Division of the Ransome Machinery Company, Dunellen, New Jersey.

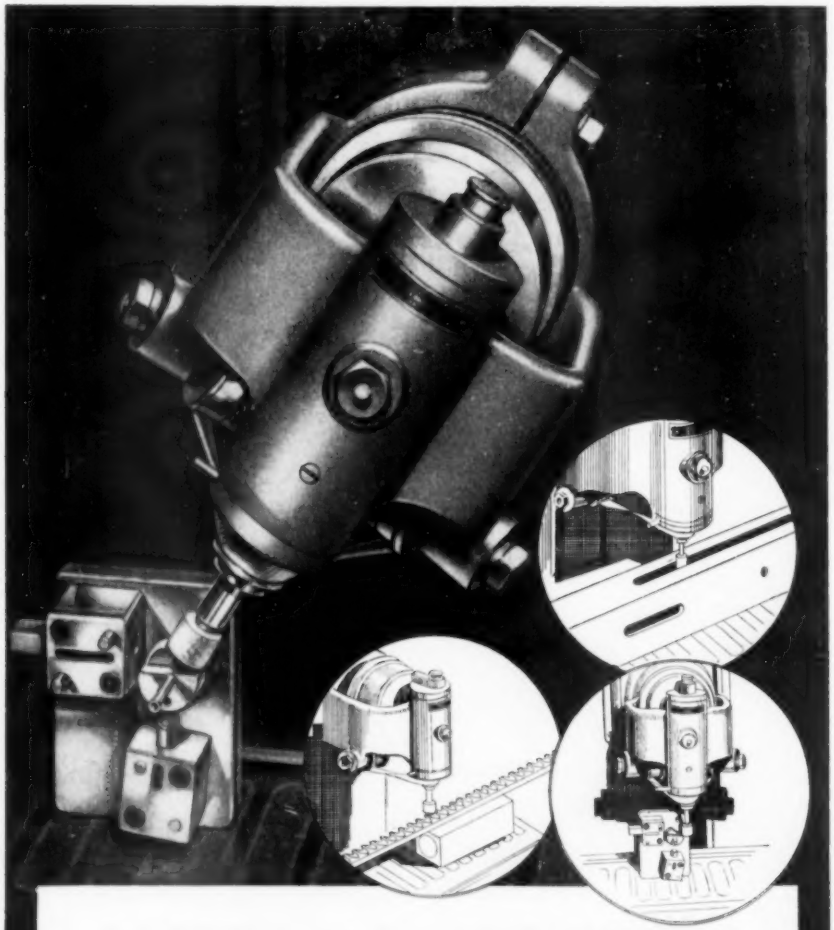


Equipment for Cylindrical Welding
Diameters from 2 to 14 feet handled.

This set consists of a pair of motor-driven rolls controlled through a Reeves variable-speed unit, giving a range of speeds to meet individual job requirements. Remote push button control is furnished with this unit for forward or reverse rotation.

The manufacturer states that means for changing the center-to-center distance of the rollers is provided. Thus work from two to fourteen feet in diameter can be handled. One or more sets of idler rolls are used, depending on the length of the cylinder being welded. The units available handle loads up to 75 tons.

(Continued on page 174)



SPEED with ACCURACY

Liberty High Speed Attachments are on and off surface grinders in two minutes.
Especially adapted for sharpening broaches and grinding hard to get at surfaces.
Sold with solid quill or collet chuck.
Write for descriptive circular and price list.

LIBERTY TOOL AND GAGE WORKS, INC.
233 GEORGIA AVE. PROVIDENCE, R. I.
With Plant Facilities for Producing Precision Aircraft Parts

Tomorrow's Tools for Today's Tasks

MIDWEST TAPER AND PIN DRIVE TYPE END MILLS *permit maximum* SPEEDS AND FEEDS

MIDWEST END MILL
Taper and Pin Drive makes tool changes possible in minimum time

END MILL HOLDER
gives perfect alignment to operation — no loose parts easily dislocated or lost

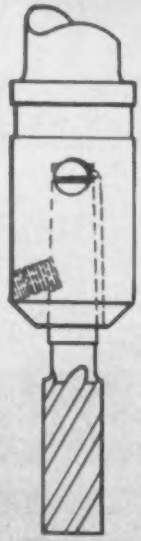
MIDWEST

THESE HIGH PRODUCTION TOOLS OFFER THE POSSIBILITY OF INCREASING YOUR PRODUCTION

Midwest End Mills are made with a high helix angle (fast spiral) to provide maximum speed in action, and with plenty of chip room to prevent clogging of chips in the flutes.

The Midwest Taper and Pin Drive tool holder has a round pin partially imbedded in the wall. A corresponding keyway in the tapered shank of the end mill fits this pin. As a result full driving energy is exerted along the entire length of the end mill shank. A safety lock screw holds the shank firmly in place. The drive is positive, rigid and always perfectly aligned.

These features in Midwest Pin Drive End Mills permit higher speeds and feeds; they result in greater production, more accurate work and exceptionally high finishes in milling operations.



ASSEMBLY VIEW
showing Midwest Pin Drive with safety lock screw

MIDWEST

Precision METAL CUTTING TOOLS

END MILLS • SLEEVES • COUNTERBORES • SPECIAL TOOLS • DRILLS REAMERS • FORM TOOLS CARBIDE TIPPED TOOLS ADJUSTABLE HOLDERS

MIDWEST TOOL & MFG. CO. • 2364 W. JEFFERSON AVE. • DETROIT, MICHIGAN

TOGGLE CLAMPS WITH PLASTIC GRIPS (K77)

A new "velvet grip" is now being supplied as standard equipment on most of the toggle clamps manufactured by Detroit Stamping Company, 356 Midland Avenue, Detroit. This device fits over and extends the full length of the handle. It is said to provide a positive hand hold plus cushioned protection for the operator's hands in both locking and releasing, regardless of whether handle is pushed over or "kicked" over.

This new grip is made of extruded plastic. According to the manufacturer, it has the appearance and physical properties of rubber and at the same time is not affected by oil or grease.

INFORMATION FREE

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METAL SAWING LUBRICANT (K78)

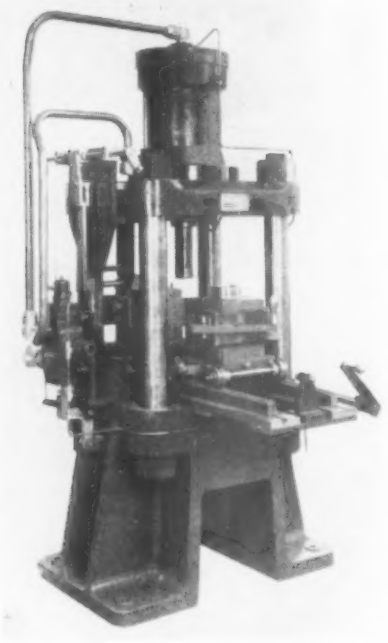
Now available to users of metal cutting saws is a new lubricant, a product of The Doall Company, Des Plaines, Ill. Said to be compounded to withstand extreme pressures, this new lubricant also minimizes scoring and heating of the saw and produces a smoother cut.

Called Doall Saw Eez, this product may also be used, according to the manufacturer, as a lubricant on lathe centers, hack saws, circular saws and other bearing surfaces which require intermittent applications of a tough film lubricant.

HYDRAULIC PRESS (K79)

Built in 25, 75 and 100 ton sizes and adaptable to capacities up to 150 ton, the new type of hydraulic press, recently announced by Hydraulic Machinery, Inc., Detroit, is identified as the K series.

The presses are driven by separate motor driven power units. They are manually controlled by a four-way valve which automatically cuts off when the predetermined pressure or tonnage has been reached.



New Hydraulic Press Model K 75
Set-up provides for 2 operators.

The accompanying illustration shows Model K 75 (75 ton at 2000 pounds per square inch on the cylinder). It has a maximum daylight of 24½ inches, a 10 inch bore and a 9 inch stroke. This set-up provides for two operators to the press. The shuttle is arranged so that when one part is under the ram, the other is located under a loading fixture.

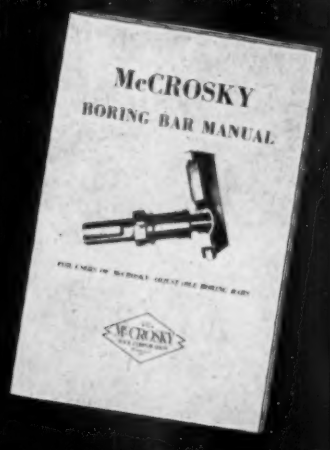
TOOL AND CUTTER GRINDER (K80)

Said to be the latest development in tool and cutter grinding equipment, this new machine is now offered by the Roan Manufacturing Company, 1225 Washington Avenue, Racine, Wisconsin. The manufacturer states that it is equipped to handle many types of milling cutters, such as side and face milling cutters, end mills, tapered or straight or spiral reamers, spot facers, counterbores, hollow mills, shell end mills and staggered tooth mills, gear

(Continued on page 176)

IMPROVE AND PROTECT YOUR PRODUCTION

Send for copies of the new McCROSKY BORING BAR MANUAL. This simple, 20-page booklet outlines operating and maintenance principles of McCrosky Adjustable Boring Blocks and Bars—gives basic grinding instructions—covers stock removal, speeds and feeds, and other details. Numerous diagrams. Write to McCrosky Tool Corporation, Meadville, Pa.



GREEN HANDS make fast work with Apex Safety Friction Tapping Chucks

INEXPERIENCED machine tool operators get the extra help they need with Apex Safety Friction Tapping Chucks. In the first place the hazard of overloading and breaking tools is practically eliminated. Taps work safely, accurately, at top speeds on thru or bottom holes.

Adjustment of the chuck for different size of taps is simple, and is maintained over long periods. End thrust set up by tapping or pressure exerted by operator on spindle will not affect friction setting. Multiple friction discs have large area and long service life.

Use these chucks on drill presses, radials, hand screws, etc., and conserve cutting tools. . . . Catalog No. 14 sent on request.

APEX

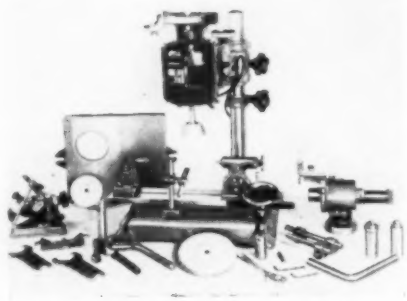
THE APEX MACHINE & TOOL CO., DAYTON, OHIO

Manufacturers of Safety Friction Tapping Chucks, Quick Change and Positive Drive Drill Chucks, Vertical Float Tapping Chucks, Parallel Floating Tool Holders, Power Bits for Phillips, Slotted Head and Clutch Head Screws, Hand Drivers for Phillips and Clutch Head Screws, Aircraft Universal Joints, Plain Universal Joint Socket Wrenches.

and form cutters and circular saws.

It is also said to be used for contour grinding and, since it is portable, it is used as a bench grinder. Having graduated adjustments throughout, the machine has a motor grinder head and bracket which can be raised, lowered or swiveled around.

To accommodate various types of tools, complete fixtures and accessories are said to be provided. Included is a precision slide which can be used independent of the grinder as a bench center for indicating and inspecting tools. Also included among the accessories is an O. D. grinding fixture which is used for holding end mills, milling cutters and special form tools which cannot be held on center.



New Roan Tool and Cutter Grinder
Has many fixtures and accessories.

AVAILABLE

TECHNICAL MEN

- ☐ MECHANICAL DRAFTSMEN
- ☐ TOOL ENGINEERS
- ☐ MACHINE DESIGNERS
- ☐ PRODUCT ENGINEERS
- ☐ PROCESS MEN

WE maintain a large and competent staff of these men who are available at a moment's notice for service either in your plant or in our own designing rooms. Whether you need one or one hundred engineers, do not hesitate to call on us. This service is effectively used by many great manufacturing plants, located in all sections of the United States. For further information telephone, wire, or write:

LA SALLE DESIGNING COMPANY
AL J. CONN, MANAGING DIRECTOR
628 West Lake Street, Chicago

LA SALLE

PRODUCTION AND MANAGEMENT ENGINEERING

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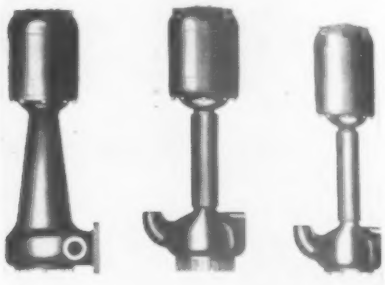
COOLANT PUMPS (K81)

Three new coolant pumps, each available in 17 standard sizes, were recently announced by Pioneer Pump and Manufacturing Company of Detroit. In design and construction, these pumps are said to eliminate critical materials.

Versatility of application is said to be a feature of the new models. They permit interchangeability with other makes of pumps and each pump presents the possibility of many different applications.



Three New Pioneer Coolant Pumps
Available in 17 standard sizes.

One of the new pumps, Model VBD, is said to be the only pump on the market with three outlets to permit piping on either right or left side or back into coolant sump through intake bracket.

Another new model is the VA which is used where submersion in coolant sump is more practical or less objectionable than outside mounting would be. The third new pump, Model VC, was designed for external use in cases where a tank cannot be utilized efficiently, mounted with either vertical or horizontal bracket.

TAP RELEASE CHUCK (K82)

This tap holder for use in turret-tail stock of lathe or on a reversible drill press was recently developed by R. E. Uptegraff Manufacturing Company, 134 Bridge Street, Scottdale, Pennsylvania. In operation, the stop on the drill press or lathe is set ¼ inch less than full travel of tap. Then, according to the manufacturer, when the tap follows in the additional ¼ inch, it releases and runs free so as not to break the tap.

It is claimed that when the machine is reversed and the lever of the machine is moved in the opposite direction, the clutch holds the tap from turning and the tap backs out.

VERTICAL MILLING ATTACHMENT (K83)

A new vertical milling attachment which will handle up to ½ inch end mills in tool steel and designed for use on both bench and floor model milling

(Continued on page 178)

a TOOL for all TOOLS

Hard chrome plating is a tool which will make all your other tools more valuable. For example:

1 Blanking dies have been known to last ten times longer and operate more efficiently when plated with .0005" thickness of chromium.

2 Chromium plated gages give 3 to 7 times the wear of best gage steels.

3 Worn tools, which might otherwise be scrapped, can be plated and reclaimed overnight.

As developed by Hartford Chrome, the successful applications of hard chrome plating are almost unlimited.

Use Hartford Chrome to expedite your own tooling problems.

Free "Know-How" Literature

Write For Our Circular "How Hard Chrome Plating Can Aid *Your* War Effort."

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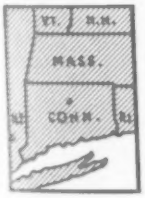


Above: *A group of miscellaneous work picked at random from the receiving bench at Hartford Chrome.*

SERVING NEW ENGLAND AND NEW YORK

machines is now being produced by the Fray Machine Tool Company, Inc., Glendale, California.

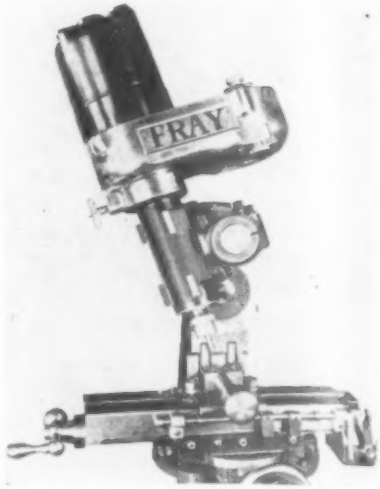
This new attachment is said to be designed so that change of cutting tools can be made quickly. It features a quick ejecting collet, with hardened tightening nut. A spanner is furnished to hold the spindle, while tightening and loosening the collet, and a wrench for the spindle nuts.

The manufacturer states that this new Type F attachment has motor bearings of the lifetime lubrication type and that there is only one lubrication point on the entire machine. Furnished with each unit is a ½ hp Frayco motor, available in either 1750 or 3500 rpm. The adjusting screw for the motor bracket is said to be so placed that the motor swings completely around the head.

Adequate squaring surfaces are incorporated on the spindle housing, according to the manufacturer. Calibration is 30 degrees — 0 degrees — 30 degrees on the vertical movement. The overarm is calibrated in 360 degrees. Overarm adapters are available in various sizes to fit standard overarms.

INFORMATION FREE

For complete information on equipment listed in this section, list the key number preceding each item and your name and address on postcard coupons—page 163.



New Vertical Milling Attachment
Handles up to ½ inch end mills.

NEW PORTABLE TEST STAND (K84)

To test the hydraulic systems of airplanes and the component parts comprising those systems, The Denison Engineering Company of Columbus, Ohio is now building a hydraulic portable test stand. The manufacturer states that this stand will check the entire hydraulic system, including the valves and lines, of aircraft operating on pressures up to and including 3000 psi.

New Portable Hydraulic Test Stand
Tests airplane hydraulic systems.

The stand is driven by a 7½ hp, 1200 rpm, 3 phase, 220 volt, constant speed motor as standard equipment. The fluid is supplied from either the airplane or tester reservoir. Working pressures are said to be adjustable over a range of 500 to 3000 psi.

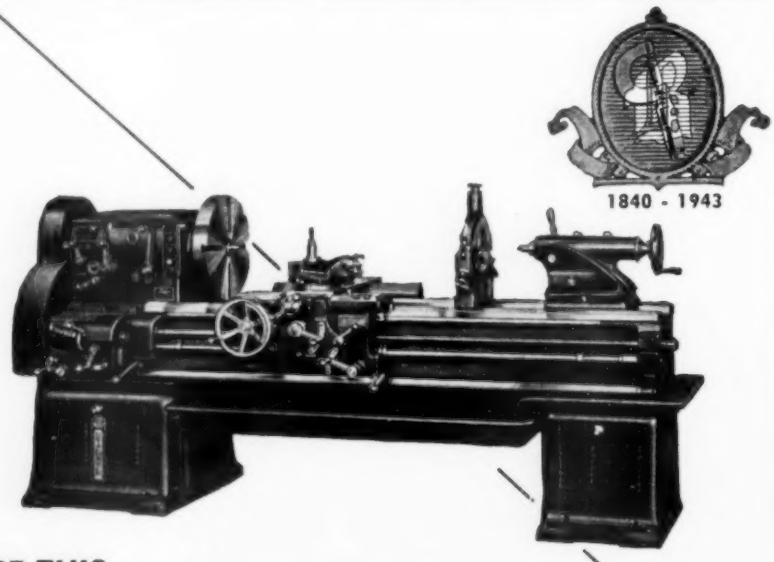
NEW SPRING STRIPPING UNITS (K85)

New, improved strippits, said to allow the removal and replacement of the stripper plate without taking the die out of the press or disturbing any part of the setup, were recently announced by the Wales-Strippit Corporation of North Tonawanda, New York.

It is also stated by the manufacturer that dulled or broken punches can be

(Continued on page 180)

LOWER PRODUCTION COSTS



USE THIS
BRADFORD
Metalmaster
LATHE

$$ are saved with this top-notch lathe! Dollars through time and materials saved on every job. The Metalmaster has twelve speeds in geometrical ratio and in both forward and reverse. A direct reading index plate indicates lever positions for all speeds. Continuous accuracy is assured by such features as the spindles that are manufactured from high carbon molybdenum steel forgings bored from the solid stock straight through from end to end and the gears which are high quality alloy steel, heat treated, shaved and lapped to close tolerances for smooth operation.

ALSO MANUFACTURERS OF DRILLING AND TAPPING EQUIPMENT

THE BRADFORD MACHINE TOOL CO.
EVANS STREET SOUTH OF EIGHTH, CINCINNATI, OHIO
PRECISION TOOLS SINCE 1840

THEY'RE Faster
AND GO FARTHER
American planes today have what it takes! Speed — wider cruising range — greater firepower — maneuverability! All this—due to the ingenuity of aviation engineers and machine tool builders — working with the right kind of tools. That's where Wesson Carbide Cutting Tools are doing their part — cutting tougher metals, faster, with greater precision, with minimum rejects. » » » Pioneers in "tooling up" for aviation motor production, Wesson Company is constantly setting new standards of precision and speed in Carbide Cutting Tools.
The counsel of Wesson engineers — skilled in engineering and designing of cutting tools — is available to help solve present war production problems, or for post war planning.
WESSON CO., DETROIT, MICH. (Ferndale Station)
WESSON
Carbide Cutting Tools
First choice when tough metals are to be cut — for special or standard purposes — for single or multiple setups.

WHEN THE WAR IS OVER we'll enjoy higher standards of living here in America. Automobiles, airplanes, tractors and trucks — household appliances — every machine and tool that's made of metal — will be better, safer, stronger.

Wesson Carbide Cutting Tools will help to make this possible by cutting *tougher* metals, with greater precision. And these things will cost less to buy — they'll operate more efficiently and more economically — they'll be safer and will last longer.

INFORMATION FREE

For complete information on equipment listed in this section, list the key number preceding each item and your name and address on postcard coupons—page 163.

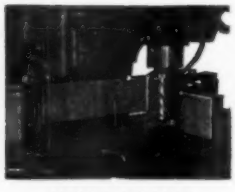
replaced without disturbing the setup. Equal pressure is said to be provided around the entire stripper plate, regardless of size, by the uniform pressure of every strippit.

The strippits are available in lengths from 2½ to 6 inches. They are said to permit the designing of more compact punch holders and die shoes.

New Wales Spring Stripping Units
Lengths range from 2½ to 6 inches.

UNIVERSAL is the word-

that well describes THE KNIGHT MILLER



HEAVY MILLING

BORING OPERATION

You bet the KNIGHT MILLER is universall It has rigidity for heavy milling, it has accuracy for boring operations, it has power for face milling and speed for light milling.

LIGHT MILLING

This universal, vertical milling machine produces more work, requires less equipment, eliminates hours of layouts and produces top quality results.

FACE MILLING

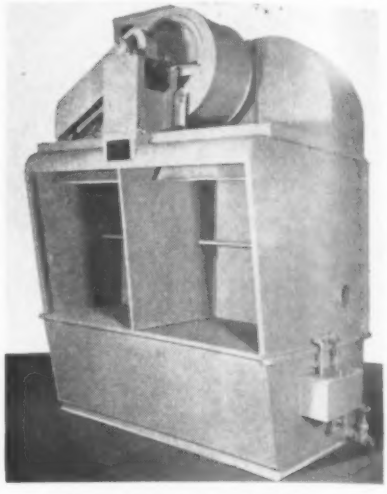
Features like these make the Knight Miller a time-saver and a profit-maker. Write us for complete information on this machine.

W. B. KNIGHT MACHINERY CO.
3920 WEST PINE
SAINT LOUIS, MO.

36 Years A Builder of Quality Milling Machines

NEW DUST COLLECTOR (K86)

Said to mark another step forward in equipment used for the processing of magnesium, the new dust collector recently announced by Industrial Equipment Corporation of Detroit is of a design that has effected economies in installation costs. A fan unit is the only mechanically moving part of this new model. Units are available for use



New Dust Collection Units
Booth or individual types.

in either booth type or individual collectors for grinding stands.

Dust laden air is drawn through an orifice causing a violent spray of water. Here the dust is "water-whirled" out of the air and is forced down into a tank below. There it forms a sludge which can be easily removed.

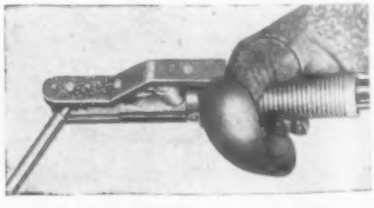
The manufacturer states that since the operation of the Hydro-Whirl permits the cleaned air to be returned to the room, less heat loss is suffered, thus giving savings in heating costs.

NEW ELECTRODE HOLDER (K87)

A new electrode holder that is air cooled was recently announced by Jackson Products of Detroit. For use on heavy metallic arc welding jobs where rods as heavy as ½ inch are used, this new holder is said to reduce the intense heat that frequently causes discomfort to the welder.

The holder is insulated and is cooled by air at from three to four pounds pressure, traveling the entire length of the lower tong. The air inlet tube can be connected to the plant air line.

It is made of special high conductivity copper alloy and has deep slotted jaws to grip the rod tightly and hold it at the correct angle. A solder cable connection is also provided.



Air Cooled Electrode Holder
Takes rods up to ½ inch.

GRINDING TIME WAS CUT

from 25 Minutes to 3 Minutes WITH DIAGONAL SHEARING

Briefly—here's the story:

Company: A large manufacturer of automatic screw machines.

Piece: Turret revolving head plate, 21¾" O.D., with broken surface.

Material: Chrome nickel steel casting.

Job: Grinding finished surface on both sides from rough casting.

Machine: Blanchard No. 18 Vertical Surface Grinder; wheel speed 720 R.P.M.; one piece per table load.

SEVERAL tests were made under actual production conditions. Using a Cortland 18" Chuck with Segments the company was able to quadruple the rate of feed, triple the table speed, and cut the grinding time from 25 minutes to 3 minutes—with only a slight increase in power expended. Here's the detail:

	CORTLAND	*Brand Formerly Used*
Stock Removed	Approx. 3/16"*	Approx. ¼"*
Rate of Feed	.032	.008
Table Speed	18	6
Ampere Readings	90-95	75
Dressings Necessary	None	1
Work Heat?	No	No
Grinding Time	3 Minutes	25 Minutes

**Stock Removed is approximate because grinding started from rough castings.*

Cortland Production Test Runs in a large number of war plants have already proved the sound common sense engineering back of *Diagonal Shearing*—a feature of Cortland Chuck and Segment assemblies. Write for the Segmental Chuck bulletin—free; and for information on grinding wheels of all types.

DIAGONAL SHEARING
Shock and resistance minimized as narrow end of segment starts grinding action. Large surface still exposed to coolant. Diagonal motion of straight inner edge of segment produces powerful shearing action. Increasing contact combines rapid stock removal with minimum heating.
Maximum area of segment in contact with work momentarily. As segment continues to pass across work, grinding area becomes smaller, with more surface exposed to coolant.

CORTLAND *Segmental Chucks*

CORTLAND GRINDING WHEELS CORP. • CHESTER, MASS.

END MILLS AVAILABLE FROM STOCK

Some sizes and types of Putnam End Mills can be supplied immediately from stock. Your Putnam representative or distributor can tell you what are now available.

CONTOUR MILLING WITH A PUTNAM END MILL

An intricate shape . . . a deep cut . . . this is a job for a Putnam Hi-Speed End Mill. Putnam End Mills are correctly designed and made of the best high speed steel. No matter how tough the job, try a Putnam End Mill. You will learn for yourself that they *do* cut faster and last longer.

PUTNAM TOOL COMPANY

2985 Charlevoix Avenue • Detroit, Michigan

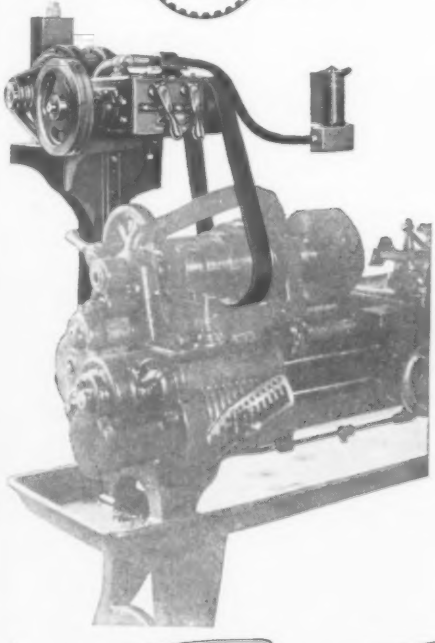
Model A Arter Rotary Surface Grinding Machines grinding cams for radial aircraft engines. This part, so highly essential to efficient operation in service, is ground to precise limits and fine finish. This is but one of many other precision jobs on which Arters are being successfully employed in the great American aircraft industrfy.

ARTER GRINDING MACHINE CO.
Worcester, Mass., U. S. A.

IT'S NO WAR SECRET—

U. S. Plants All Over the Country Are Doing This!

TURNER UNI-DRIVE
Motorizes Machine Tools



NO SIR! Hitler and Hirohito, this is no military secret . . . you are most welcome to this information, because every time a shop or factory installs the Turner UNI-DRIVE units, they bring your ultimate and inevitable defeat and destruction one more day nearer . . . Axis Agents, please clip and mail Tojo partial list of Turner UNI-DRIVE users printed here.

TOMORROW'S production *today!* That's what the installation of Turner UNI-DRIVE units in your shop or plant may mean. Each unit operates independent of all others. It eliminates overhead pulley adjustments, counter shafts, ceiling vibrations, spindle speeds, belts to shift. Provides high and low speeds on all equipment at a touch of the gear box, started or stopped independently of other equipment in operation.

Increase Production Capacity 25% to 300%

IN HUNDREDS of shops and plants all over the country, these modern motorizing units with their selective, individual sliding gear transmission, are speeding up production capacity 25% to 300%. Can be quickly and easily installed in 2 to 4 hours. Specially designed for Lathes, Milling Machines, Shapers, Turret Lathes, Radial Drills, Boring Mills, Hobbing Machines . . . also Browne & Sharpe and Cleveland Automatic Screw Machines, and easily adapted to many special applications.

See your dealer today or write

THE TURNER UNI-DRIVE COMPANY
(Sales Div. Turner Machine Co.)
Kansas City, Missouri
3416 Terrace Street

SOME USERS OF TURNER UNI-DRIVE

Aberdeen Proving Ground
American Brake Shoe & F. Co. Kellogg Division, Southern Wheel Division
Arnold Schwinn & Co.
Augusta Arsenal
Automatic Sprinkler Co. of of America
Bendix Aviation Corp.
Bodine Electric Company
Buckeye Portable Tool Company
Burgess Battery Corp.
Cessna Aircraft Corp.
Champion Dishwashing Company
Chicago, Rock Island & Pacific R. R. Co.
Chicago Screw Company
Cincinnati Time Recorder Company
Combustion Engineering Co.
Congoleum Nairn, Inc.
Doehler Die Casting Co.
Driver Harris Co.
Easy Washing Machine Corp.
Electric Auto-Lite Co.
Fostoria Screw Products Co.
Frankfort Arsenal
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May Hosiery Mills
Missouri Pacific R. R. Co.
Monsanto Chemical Co.
The New York Air Brake Co.

NOW AT WORK FOR VICTORY ★ ★ ★

PRODUCING MACHINE TOOL DRIVES • ORDNANCE TOOLS • AIRCRAFT FITTINGS

NEW LITERATURE*

OF INTEREST TO PRODUCTION EXECUTIVES

*T.M. REG. U.S. PAT. OFF.

(739) Machine Tools

Presenting Hardinge Precision Products. 16 pp. Hardinge Brothers, Inc., Elmira, New York. This new bulletin describes and illustrates the line of Hardinge lathes, second operation machines, milling machines, master collets, feed fingers, circular form and cut-off tools, speed collet chucks and collet index fixtures.

INFORMATION FREE

To receive the booklets listed in this section, list the key number found on the heading of the desired literature and your name and address on the postcard coupons—page 163.

(740) Automatic Machine Operation

Handbook for Operators. 112 pp. Cone Automatic Machine Company, Inc., Windsor, Vermont. This new handbook covers the operation of the six spindle automatics manufactured by this concern. It is completely illustrated with line drawings and photographs to help the reader. A table of contents and an index are included.

(741) Grinding Wheels

Helpful Hints and Safety Suggestions. 64 pp. Macklin Company, Jackson, Michigan. This new booklet explains the grinding wheel and how it is made. It tells the basic precautionary steps to take in using them, how to get better finishes and more production. Illustrations are included.

(742) Brazing

Brazing With Phos-Copper. 12 pp. Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa. This new booklet tells how to braze with Phos-Copper, a brazing alloy that can be used with gas, incandescent carbon, electric furnace and dip brazing methods. It contains hints on good brazing and proper joint designs. Butt, scarf, shear and lap joints are mentioned.

(743) Electric Tools

Maintenance Manual on Electric Tools. 20 pp. Independent Pneumatic Tool Company, 600 West Jackson Blvd., Chicago. How to get maximum service from portable electric tools is the theme of this new booklet. Pocket size, it contains complete instructions on the proper operation and care of all portable electric tools.

(744) Metal Sawing Machines

Racine Metal Sawing Machines for Armament Work. 4 pp. Racine Tool and Machine Company, Racine, Wis. This new folder describes and illustrates the machines manufactured by this concern for cutting of shell, rifle, torpedo flasks, bomb-ends, cannon and gun barrel forgings. It gives complete information on the adaptability of these machines to special cutting work.

(745) Planetary Milling

Plan-O-Mill No. 5. 18 pp. Plan-O-Mill Corporation, Hazel Park, Michigan. The catalog includes a large illustration of the machine with tabled features and specifications. The principle of planetary milling is explained and illustrated. Actual case histories of Plan-O-Mill form and thread milling in war production are given.

(746) Tools

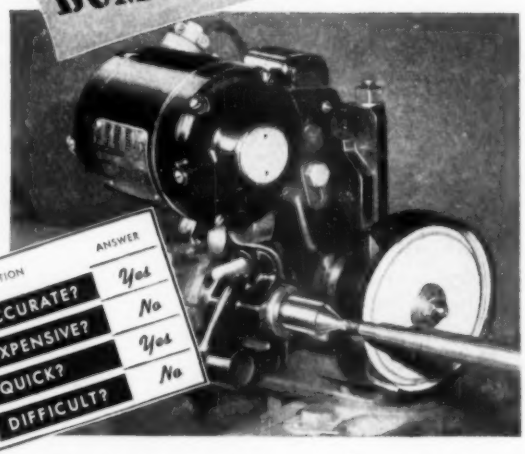
Super Carbide Tipped Tools. 28 pp. Super Tool Company, 21650 Hoover Road, Detroit. In addition to the tabula-

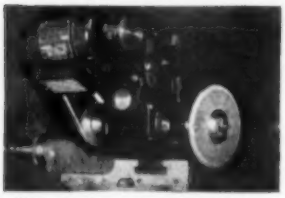
(Continued on page 186)

Thread Grinding Simplified

WITH DUMORE GRINDERS

Grinder mounts on special post with lugs for quill and graduations for helix angle.





Here is the set-up, as seen from back of lathe. Motor is up and back from work.

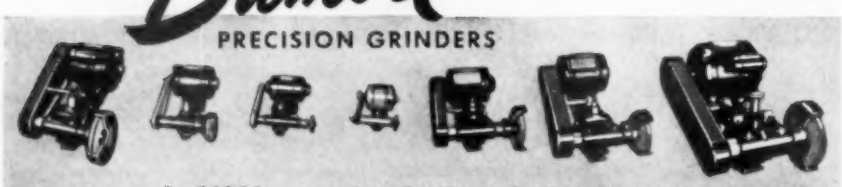
Arrow shows graduated arc for setting wheel dresser to same helical angle as grinder.

Any lathe that can cut threads becomes a thread-grinding machine by replacing the chasing tool with a Dumore No. 5 Grinder equipped with thread-grinding attachment. You can cut threads from solid stock, finish threads already roughed out with cutting tools, or correct threads distorted by hardening . . . all within the regular Dumore tolerance of .0001". ★External threads are limited only by the pitch and diameter the lathe will handle. Internal threads, in wide range of depths, pitches and diameters can be ground using Dumore internal quills. This time-saving, machine-saving system is a simple set-up with mathematically accurate adjustment of helix angle, plus an equally accurate device for diamond-dressing the wheel. Dressers are available for 60-degree threads, Acme, and other special thread forms. ★Enjoy the versatility of the Dumore No. 5 Grinder . . . when you've finished your threading jobs use it for fast and accurate cylindrical, taper, and flat grinding on lathes, boring mills, planers and other machine tools. Dumore Precision Grinders and attachments are available through mill supply distributors.

Dumore

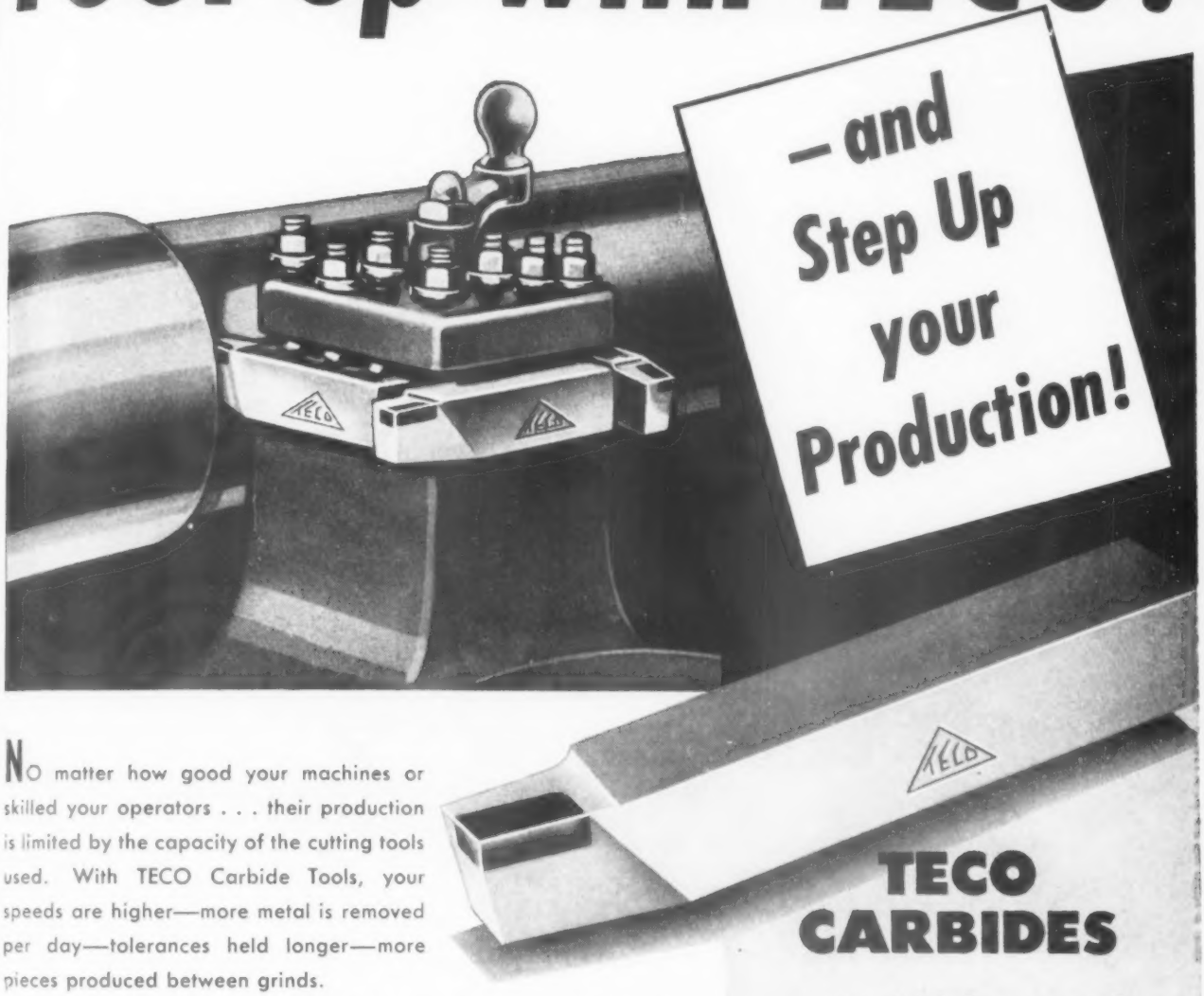
THE DUMORE COMPANY
DEPT. 223-F RACINE, WISCONSIN

PRECISION GRINDERS



7 SIZES . . . 54 QUILL COMBINATIONS

Tool up with TECO!



NO matter how good your machines or skilled your operators . . . their production is limited by the capacity of the cutting tools used. With TECO Carbide Tools, your speeds are higher—more metal is removed per day—tolerances held longer—more pieces produced between grinds.

TECO Carbide Tools are proving this every day throughout the "who's who" of American metal working plants. And the reason is found in the harder, denser, more uniform TECO Carbide which has greater resistance to wear and breakage. TECO Carbide Tools and Blanks are available promptly for practically all turning, boring, facing and cut-off operations. Tell us your needs. Write for new catalog giving full specifications.

TUNGSTEN ELECTRIC CORPORATION
570 39TH STREET, UNION CITY, NEW JERSEY
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TECO CARBIDES

...cut at higher speeds

. . . hold cutting edges longer

...produce more pieces between grinds

... reduce grinding and re-tooling time

Pioneers in Tungsten Carbides for over a Quarter Century

TECO CARBIDE TOOLS

tion of specifications and illustrations of special tools, this new catalog is said to give a picture of the organization. An index is included in the catalog.

(747) Gear Finishing

Gear Finishing. 32 pp. Michigan Tool Company, 7171 East McNichols Road, Detroit. According to the manufacturer, this new catalog is said to have been prepared to answer many questions about gear finishing by the shaving process. Many illustrations are included in this catalog.

(748) Machine Tool Plant

A Report to the Nation. 68 pp. Lombard Governor Corp., 100 Main Street, Ashland, Mass. This new book shows the plant, products and versatile methods of machining developed by this concern. Fully illustrated, it shows the history of the company, background of the business and future prospects.

INFORMATION FREE

To receive the booklets listed in this section, list the key number found on the heading of the desired literature and your name and address on the postcard coupons—page 163.

(749) Synthetic Rubber

The Properties of Ameripol D. 8 pp. The B. F. Goodrich Company, Akron, Ohio. This is a revised edition of the catalog section on this oil and heat resisting synthetic rubber used in many specialized industrial applications. It is illustrated and two pages are devoted to tables listing the properties of the various compounds of Ameripol D.

(750) Bearings

Miniature Precision Bearings. 4 pp. Miniature Precision Bearings, Keene, New Hampshire. Included in this new bulletin is the complete line of radial and pivot type bearings from 1/8 to 5/16 inches outside diameter in both steel and non-magnetic beryllium manufactured by this company. Dimensions and load ratings at varying speeds for each size and type of bearing are tabulated.

(751) Variable Speed Transmission

Reeves Variable Speed Transmission with Built-In Reducer. 16 pp. Reeves Pulley Company, Columbus, Indiana. Completely illustrated, this new catalog contains description of the reducer-type transmission as well as engineering data and rating tables for the selection of a unit of the proper size.

(752) Cutting Tools and Blanks

Kennametal Steel Cutting Carbide Tools and Blanks. 40 pp. McKenna Metals Company 600 Lloyd Avenue, Latrobe, Pa. Divided into three sections, this new catalog devotes space to standard tools, typical non-standard tools and a section giving general information. Diagrams show clearance and rake angles, sizes of the tips and shank dimensions.

(753) Lathes

South Bend Lathes. 48 pp. South Bend Lathe Works, South Bend, Indiana. A new catalog that describes the entire line of engine, toolroom and turret lathes manufactured by this company, it includes attachments and accessories. Each size and type of lathe is illustrated and specifications are tabulated.

(754) Riveting

How to Use Du Pont Explosive Rivets For High-Speed Blind Riveting. 6 pp. Explosives Department, E. I. Du Pont de Nemours & Company, Inc., Wilmington, Del. This new illustrated bulletin contains complete information on selection of the proper size and type of rivet, preparing rivet holes, handling, storing and expanding the rivet and use and maintenance of the riveting iron.

(755) Diamond Dust

Diamond Dust. 4 pp. J. K. Smit & Sons, Inc., New York City. This new illustrated folder is said to be a timely and interesting presentation in what to look for in diamond dust for industrial purposes.

(756) Refrigerated Welding

The Frostrode Process. 4 pp. Frostrode Products, 19003 John R. Street, Detroit. Design and operating features of this process are described in this new bulletin. This includes the refrigerator units, welding electrodes with replaceable tips, and adapters to convert any

(Continued on page 188)

CIRCLE "R"
Metal Cutting Tools

Made by Perfectionists

★

Also Metal Cutting Saws of all types

★

CIRCULAR TOOL CO., INC.
PROVIDENCE, R. I.
CHICAGO • PHILADELPHIA • NEW YORK
DAYTON • CLEVELAND
INDIANAPOLIS • DETROIT • ST. LOUIS

Our combination drills and countersinks are milled on this machine designed by our own engineers. Depth of cut and spiral are automatically controlled, assuring accuracy and uniformity.

INCREASED PRODUCTION DECREASED ACCIDENTS

SAFETY GRIP-LOK GRINDING WHEELS

If you haven't investigated, there is a new way to insure against grinding wheel injuries to workmen, property damage, and costly time delays by insisting in your specifications that all portable grinding wheels bear the name SAFETY GRIP-LOK.

If unfamiliar with the features of Safety Grip-Lok Grinding Wheels, send your specifications for a trial wheel for use on portable grinders for

Aluminum	Frogs & Switches (Manganese)	Steel Castings (Low Carbon)
Billets	Malleable Castings (Annealed)	Steel Castings (Manganese)
Cast Iron	Welds (Carbon Alloy Steel)	

We are confident that once you use a Safety GRIP-LOK Wheel you'll specify them regularly.

THE SAFETY GRINDING WHEEL AND MACHINE COMPANY

SPRINGFIELD, OHIO — SALES OFFICES IN PRINCIPAL CITIES — ESTABLISHED IN 1892

MANUFACTURERS OF SAFETY MOTOR DRIVEN PORTABLE GRINDERS, SAFETY RITE-SPEED GRINDERS, GRINDING WHEELS FOR EVERY PURPOSE, INCLUDING THE FAMOUS "SAFETY GRIP-LOK GRINDING WHEELS"

standard resistance welder to use of the refrigerated welding process.

(757) Dust and Fume Control

Schmieg Dust-and-Fume Control Equipment. 42 pp. Schmieg Industries, 342 Piquette Avenue, Detroit. Illustrations in this new book show actual installations of dust and fume control equipment, spray booths, mechanical washers and industrial ovens. Engineering details, capacities and dimensions are given. A section is devoted to sheet metal equipment.

(758) Clamps

Marmon Clamps. 6 pp. Marmon Products Company, 940 West Redondo Blvd., Inglewood, Cal. Included with this new folder is a specification sheet and ordering guide. These new clamps for all types of dust and hose installations are described and illustrated. One illustration shows how a clamp replaces a heavy casting.

INFORMATION FREE

To receive the booklets listed in this section, list the key number found on the heading of the desired literature and your name and address on the postcard coupons—page 163.

(759) Protective Coatings

Corrosion Can Be Controlled. 28 pp. Protective Coatings Incorporated, Detroit. This new booklet discusses various types of technical, industrial and metal coatings. A description of the "Black Magic" process is included.

(760) Scrapers

Scrapers For the Metal Working Industry. 4 pp. Murcott & Campbell, Inc., 582 Union Avenue, Brooklyn, N. Y. Illustrations, descriptions and specifications are given in this new bulletin. Among the scrapers mentioned are flexible, rigid, gouge, edge-burring, three-edge, double-end plain and bearing types.

(761) Milling Machines

Cincinnati No. 2-24 Automatic Rise and Fall Milling Machine. 20 pp. The Cincinnati Milling Machine Co., Cincinnati, Ohio. The new edition of this booklet is said to have a center section of especial interest which shows about twice the former number of standard automatic feed cycles, and one special cycle typical of several which have been designed for set-ups requiring feed to the right and left.

(762) Check Valve

New A. S. P. Universal Check Valve. 4 pp. American Screw Products, 7000 Avalon Blvd., Los Angeles. This folder describes and shows how a few standard parts can be used to obtain many combinations. It explains why this valve is called 12 valves in one.

(763) Wheel Dressing Tools

Diamond-Pointed Precision Tools by Adamant. 2 pp. The Adamant Tool Company, 209 South State Street, Chicago. This new folder describes and illustrates a number of different wheel dressing tools. Recommended wheel sizes are listed.

(764) Angle and Radius Dresser

The Form-Master. 4 pp. J & S Tool Company, 477 Main Street, East Orange, N. J. Illustrated and described in this new booklet is a new product for angle and radius dressing of abrasive wheels. Line drawings show forms obtainable in dressing radius or angle with this product.

(765) Machine Tool Lighting

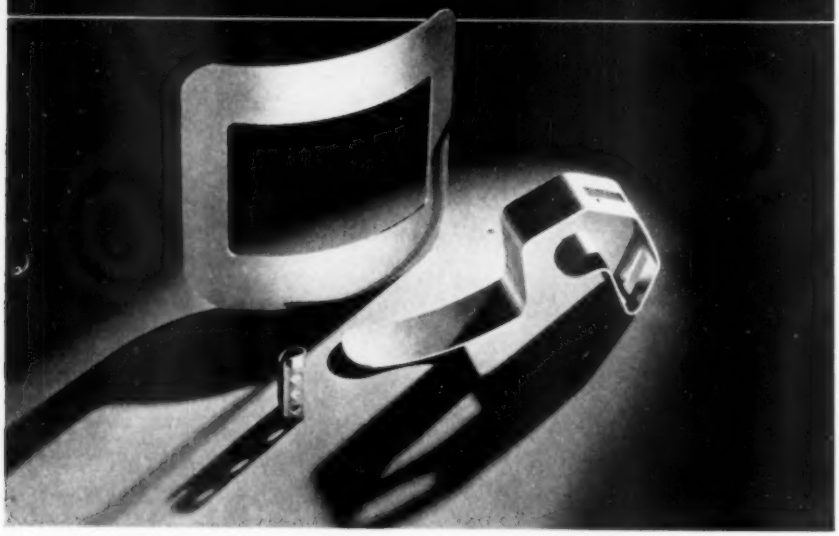
Swivelier Work-Lite Units. 4 pp. Reliance Devices Company, Inc., 510 Sixth Avenue, New York City. Typical applications of this light are shown in this new catalog. Line drawings show the adjustable features of the socket and the base. Specifications are included.

(766) Heat Treating Furnaces

Lindberg Furnaces For the Heat Treatment of Aluminum and Magnesium. 8 pp. Lindberg Engineering Company, 2450 West Hubbard Street, Chicago. Photographs and sketches in this new bulletin show many applications of these furnaces. It shows the types available, explains the zone control method of heating large loads and gives construction features.

THE END

the *unusual* in Springs
is *not unusual* at Muehlhausen



★ Muehlhausen has provided the answers to many challenging spring problems—provided them at a speed in keeping with war-time demands. Unusual spring requirements have been successfully met with unusual spring designs—made possible by this company's widely varied experience, plus engineering skill and extensive production facilities.

Springs of every shape and size, in quantities large and small, are part of everyday production. Muehlhausen craftsmen are able to produce the correct spring for every requirement—whether a tiny compression spring that will be flexed a hundred times a minute; or a large, hot-formed spring that must withstand extreme operating temperatures.

This ability of Muehlhausen to design and fabricate unusual springs has permitted greater latitude in designing war products now, and will enable engineers to plan, with greater freedom, the products of tomorrow.

MUEHLHAUSEN SPRING CORPORATION

Division of Standard Steel Spring Company

625 Michigan Avenue, Logansport, Indiana.

TWO NEW FOLDERS—FREE

New Die Spring Bulletin illustrates, describes 206 sizes and types of die springs.

★

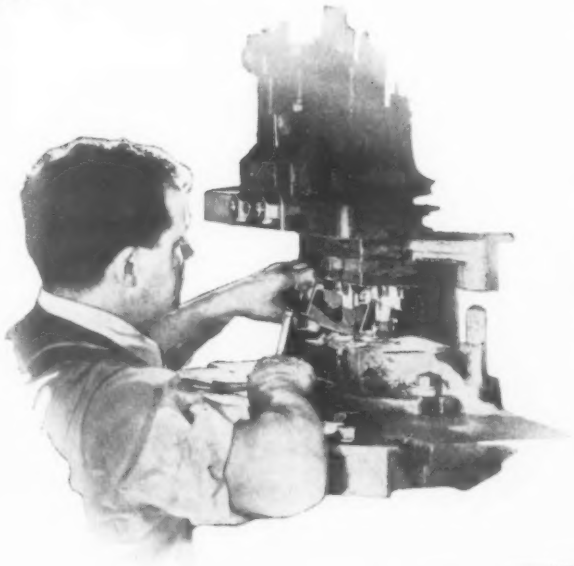
New Armament Bulletin shows the importance of springs for many types of war equipment.

MUEHLHAUSEN SPRINGS

EVERY TYPE AND SIZE

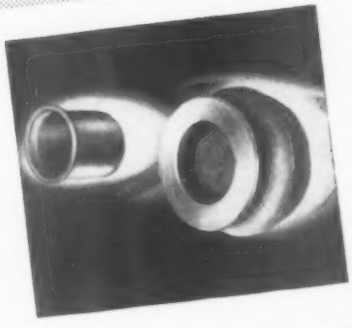
How to REDUCE Machine Shut-Down Time

by getting longer runs between grinds



Certainly one of the biggest problems of all-out production is finding ways to prevent loss of machine time caused by frequent shut-downs to redress, regrind or replace tools that wear too rapidly or fail too soon. If *you* could get ten minutes to several hours' extra production time per day from each machine in *your* plant, wouldn't it make *your* production schedules easier to meet?

Many busy war plants have found a way to do just that—by using the Carpenter Matched Set Method of tool steel selection. Because it provides a definite *system* for selecting the one steel that is best for each tool, this method helps to get tools that give uninterrupted production—that run longer between grinds. Given here are two actual production line examples of how it works.



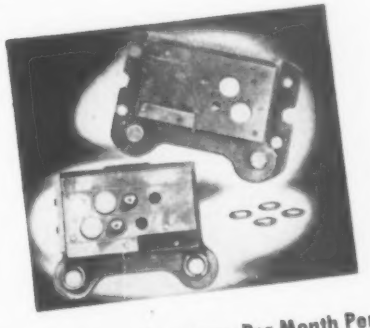
42 More Productive Hours Per Month Per Press

THE JOB: Drawing a bearing retainer out of plain hot rolled steel ⅛" thick. Rated capacity of press, 1,250 pieces per hour.

THE PROBLEM: Oversize wear after 4,000 pieces —replacement of tool with duplicate consumed 1 hour during which press was idle.

THE SOLUTION: A change in tool steels in the direction indicated by Carpenter's Matched Set Method of Tool Steel Selection.

THE RESULTS: An increase in *tool life* from 4,000 pieces to 86,000 pieces per tool. A decrease in press shut-down time of 42 full working hours per month. A gain in production of 52,500 pieces per month.



63.8 More Productive Hours Per Month Per Press

THE JOB: A fast blanking operation on a press operating at 7,200 pieces per hour.

THE PROBLEM: Burrs after every four hours, necessitating 2½ hours shut-down time for pulling the die, regrinding and replacing.

THE SOLUTION: The company switched to the steel indicated by the Carpenter Matched Set Method.

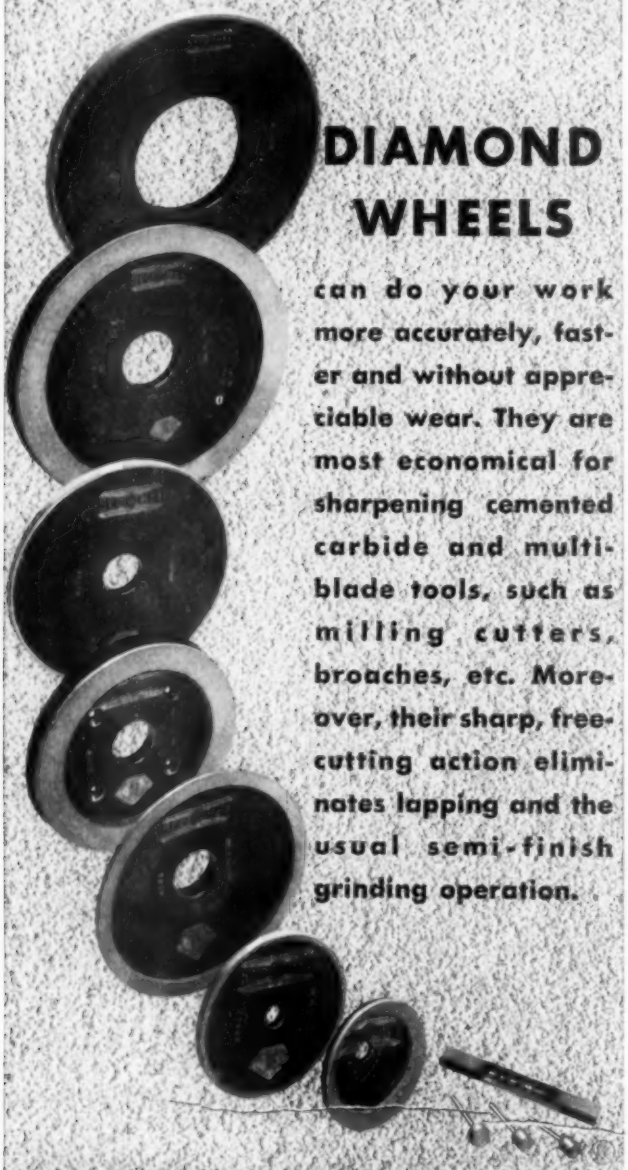
THE RESULTS: An increase in time between grinds from 4 hours to 35.8 hours. A decrease in press shut-down time of 63.8 hours per month. An increase in production of 460,000 pieces per month.

If you are interested in getting more output in *your* plant, the Matched Set Method can help you. A request on your company letterhead will bring you helpful information about it. Or for "on the spot" service, your Carpenter representative will be glad to give you every assistance.

The Carpenter Steel Co., **122 Bern St., Reading, Pa.**

Carpenter
MATCHED
TOOL STEELS

SECOMET



DIAMOND WHEELS

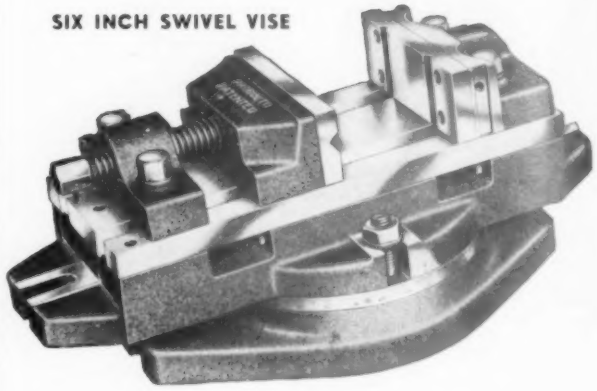
can do your work more accurately, faster and without appreciable wear. They are most economical for sharpening cemented carbide and multi-blade tools, such as milling cutters, broaches, etc. Moreover, their sharp, free-cutting action eliminates lapping and the usual semi-finish grinding operation.

J. K. SMIT & SONS

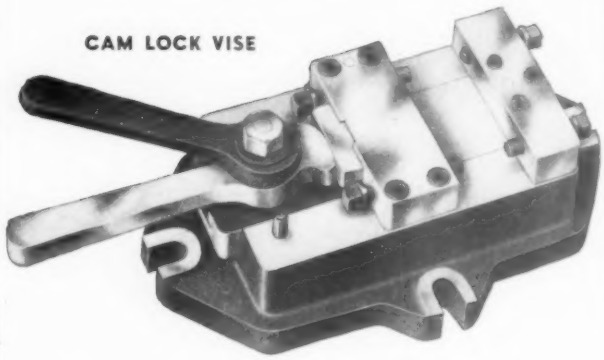
157 Chambers St., New York, N. Y. 6400 Tireman Ave., Detroit, Mich.

PRODUCTO ..... Vises ..

SIX INCH SWIVEL VISE



CAM LOCK VISE



Why waste time with old or worn Vises for Milling Machines, Drill Presses, etc.? Producto Modern Machine Vises have certain features for extra strength and gripping power. Most wearing parts are hardened for long wear and tear.

Screw-acting Vises—3 sizes—4½", 6" and 9".
Cam Lock Production Vises—3 sizes—4", 5" and 7".

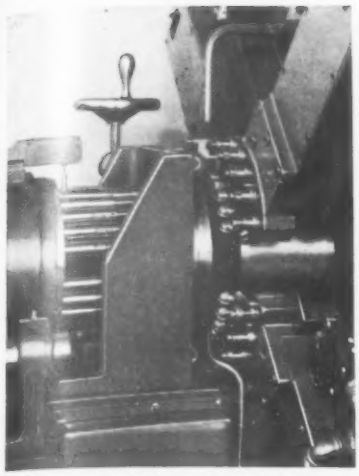
Quick-Lok Vises for Drill Presses and Surface Grinders 2 sizes—3" and 4".

Large production schedule insures reasonably quick shipments.

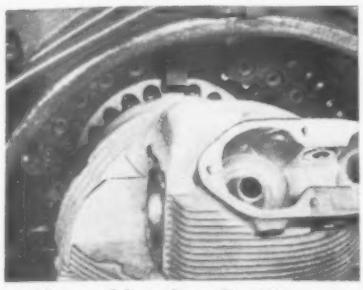
Ask for 8 page circular for full information.

The PRODUCTO MACHINE COMPANY

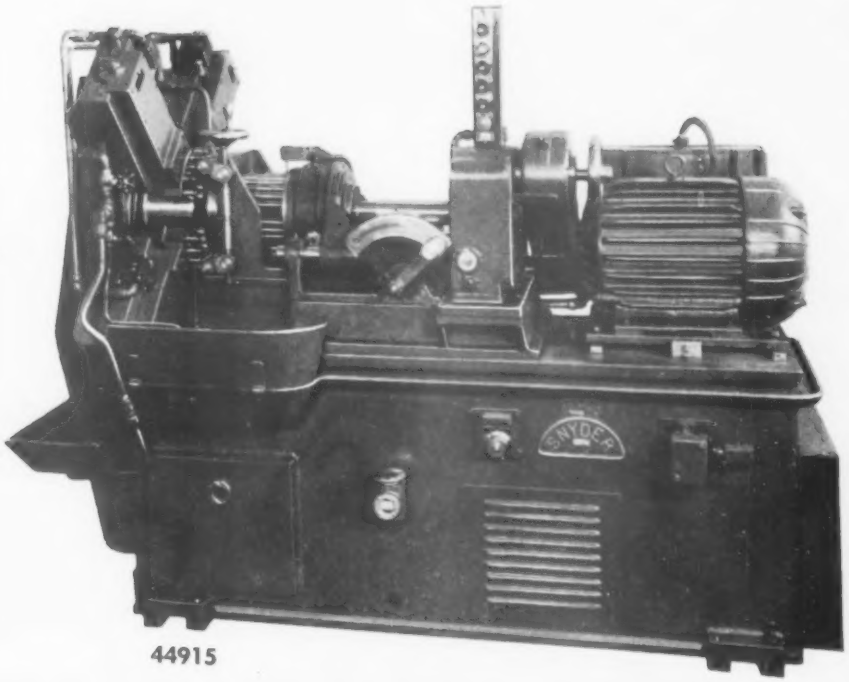
940 HOUSATONIC AVE. BRIDGEPORT, CONN.
3017 MEDBURY DETROIT, MICH.



View of Cutting Assembly



View of Loading Position



44915

MULTIPLE-SPINDLE HYDRAULIC BACK SPOTFACING MACHINE

THIS special multiple-spindle machine was designed and manufactured by Snyder to back spotface at one time the entire set of bolt holes on the flanges of cylinder barrels for aircraft engines. It has a production rate of 26 pieces or more per hour.

The cylinder head assembly is loaded and clamped manually in a horizontal position on a sliding fixture. Cutting tools run in plain nitrided steel bushings and are mounted on hydraulically actuated tool slides, which move away from the work to facilitate loading.

After the part is located, the cutters are brought into correct working position. The multiple-spindle driving head is then manually advanced so that the drivers pass through the bolt holes and engage the cutting tools for spotfacing. The operator rotates the drivers manually to assure full engagement with the cutting tools. It is not necessary for him to touch the cutting tools. With the drivers and tools fully engaged, the Snyder machine is ready for its working cycle. This consists of rotating the tools under power and feeding the cylinder head against the cutters. When the full depth of cut has been reached, the tools dwell in the work momentarily for a smooth finish of the machined surface. The base of the machine contains coolant as well as hydraulic tank and piping.

This special application of a multiple-spindle machine is another example of how Snyder engineering has helped manufacturers of aircraft, gun and tank parts to step up production and, in many cases, to secure greater accuracy. For other examples, as well as details of standard Snyder machines which often accomplish the results of special machines, write for the new Snyder book of machine tools.

SNYDER
TOOL & ENGINEERING CO.
3400 E. Lafayette Ave. • Detroit

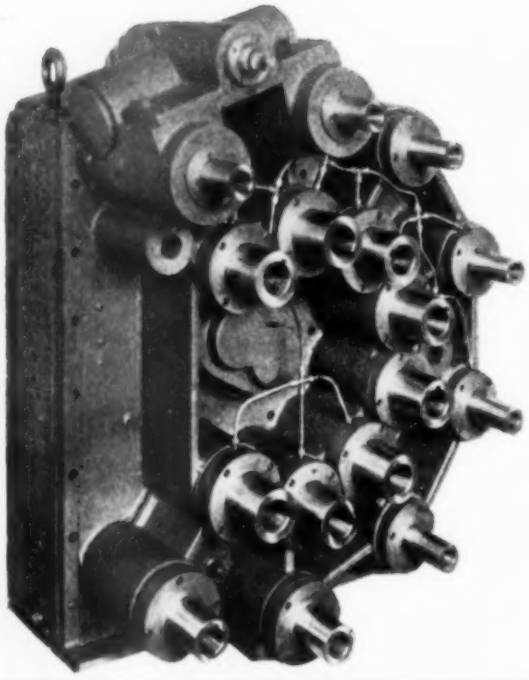
designers and builders of machinery for **HIGH** *production at* **LOW** *unit cost*

Buhr

MULTIPLE SPINDLE DRILL and TAP HEAD

RETOOLING

DOES ITS BIT FOR WAR PRODUCTION

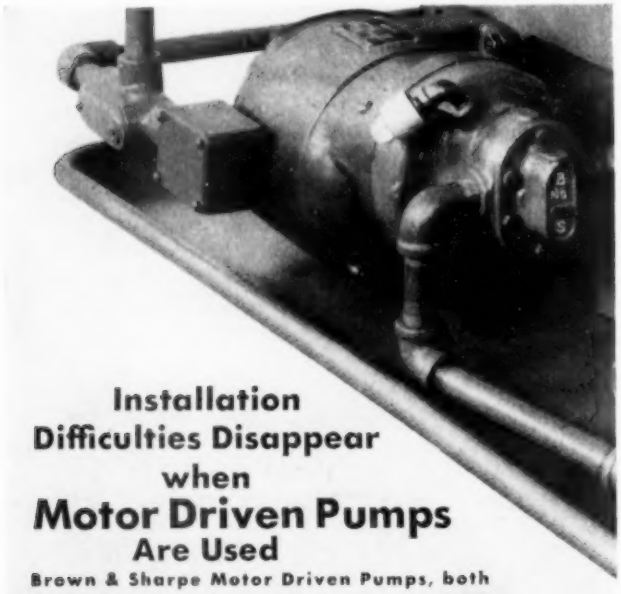


Sixteen-spindle Buhr Drilling, Counterboring, Facing and Reaming Head, designed for the left-hand head of a 2-way Machine. Vertical adjustment. Two top spindles are accelerated to give three times the feed of the other spindles. Oil pump provides positive lubrication.

BUHR MACHINE TOOL CO.

ANN ARBOR MICHIGAN

Specialists in Multiple Spindle Drilling, Boring, Reaming, and Tapping Equipment



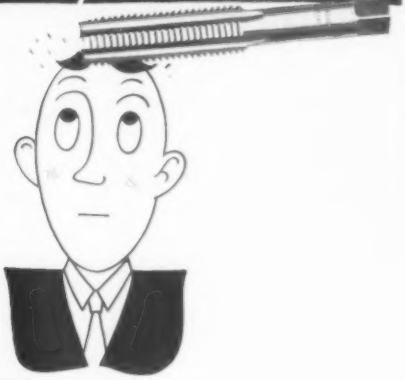
Installation Difficulties Disappear when Motor Driven Pumps Are Used

Brown & Sharpe Motor Driven Pumps, both Rotary Geared and Centrifugal, are suited for mounting in almost any convenient position on the machines they serve. Illustration shows geared model installation—horizontal mounting. Send for catalog listing complete line of Geared, Vane, Centrifugal and Motor Driven Pumps. Brown & Sharpe Mfg. Co., Providence, R.I., U.S.A.

B·S

BROWN & SHARPE PUMPS

taps on your mind?



Ask Your

THREADWELL DISTRIBUTOR!

Personal attention to your orders for Taps by the Threadwell distributors can often save days of waiting. Threadwell HIGH SPEED Taps can be identified by the dot on the shank (red for cut thread, white for commercial ground, and blue for precision ground). They can also be identified by their OUTSTANDING performance on your production line. Threadwell Tap and Die Co., Greenfield, Mass., U S A

Export Stocking Distributors

CANADA: BRIDGE MACHINERY CO., MONTREAL

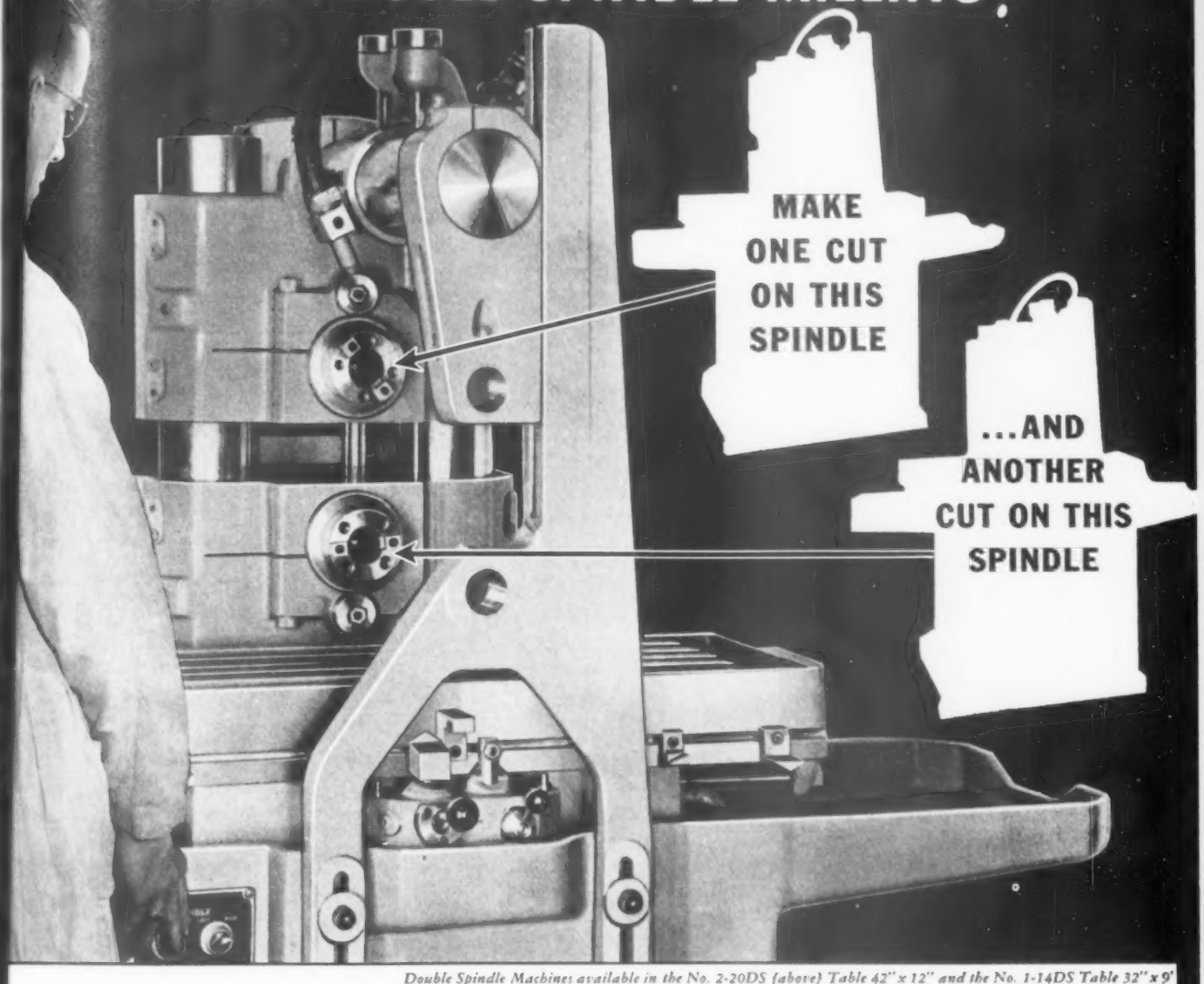
ENGLAND: SKYLUX LTD., LONDON

Threadwell

"TAPS OF DISTINCTION"

One MACHINE DOES THE WORK OF *Two*

WITH DOUBLE SPINDLE MILLING!



Double Spindle Machines available in the No. 2-20DS (above) Table 42" x 12" and the No. 1-14DS Table 32" x 9'

THERE'S A KENT-OWENS REPRESENTATIVE NEAR YOU

BOSTON
General Machinery Corp.
BUFFALO
Don W. Patterson
CHICAGO
Neff, Kohlbusch & Bissell
DALLAS
Hamilton-Huster Machinery Co.
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DETROIT
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HOUSTON
Oliver H. Van Horn Co., Inc.
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Oatis-Booth Machinery Co.
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LOS ANGELES
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Harron, Rickard, & McCone
MILWAUKEE
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MOLINE
John J. Normoyle Co.
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Oliver H. Van Horn Co., Inc.
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Wilson Brown Company
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TORONTO
F. F. Barber Machinery Co.
WALKERVILLE
F. F. Barber Machinery Co.

● Manpower and machine-power do a double job . . . with Kent-Owens Double Spindle Milling Machines!

Typical operations for these machines include: (1) sawing or splitting full circle bearings into two parts; (2) face milling two parallel surfaces or milling two parallel slots at the same time; (3) milling gear, cutter, spline and ratchet teeth . . . milling two opposite teeth simultaneously.

Thus, whenever the character of the work permits two cuts at the same time on the same piece, or the handling of two identical or different parts simultaneously, these machines will practically *double production!* Contact your nearest representative or write us. Kent-Owens Machine Company, Toledo, Ohio.

Call on KENT-OWENS *for Milling Machines*

Handy Andy Says—

T.M. REG. U.S. PAT. OFF.

A CORRESPONDENT WANTS to know why a certain manufacturer failed to acknowledge an idea for improving his product. "Perhaps," somewhat plaintively, "he thinks I'm a crackpot . . .". Naturally, I don't know why the recipient didn't answer. He should have, if only in common courtesy — at least eventually. (Take me, f'rinstance; I answer all mail, even if it takes years). But about that "crackpot" business, now. Everybody with new ideas is a crackpot to the sticks-in-the-mud, and if all had been put in the hoosegow we'd still be wallowing in medievalism.

John Ericsson and Simon Lake were crackpots to the mossbacks in the Navy, as was Billy Mitchell to the traditionists in the Army. But oh, their vindication! And Edison and Ford have shared the appellation along with Judge Ben Lindsey and Bertrand Russell; now, it's Jack & Heintz. Born a few centuries sooner, they'd all have been anathematized, as were Galileo, Copernicus and Guthenburg, "crackpots" in their day. And, in the day of WAACS and WAVES, we might as well include a few women, as Ellen Key, Mrs. Pankhurst, Margaret Sanger and Annette Kellerman (Ah, there was a gal!). No, the crackpots are okay; they make the world go 'round. It's the screwballs that gum up the works.

▲ ▲ ▲

I see by the papers where several engineering firms have got in Dutch with the government because, allegedly, they charged $3.50 per hour for services while only paying their men $1.00. The difference, as I get it, was "profiteering", which may or may not cover a multitude of sins. But, since most manufacturers add 100% for overhead, $3.50 per hour for highly technical services is not only conservative but, in my opinion, entirely fair. Furthermore, the rates were agreed upon by clients who, presumably, knew their business. Apparently, they have no complaint.

Not knowing all the circumstances, I'm not whitewashing the accused firms. But I know, from long experience, that the majority of consultants lean backward in their honesty, would be inclined to cut rather than "pad" if a job ran over a fair price. That reduces paper profits, just as there would be a loss if a concern were not permitted to charge for the time of a leader who also works on the board. It has come to my attention that government accountants have cancelled out such time, with serious loss to the firm.

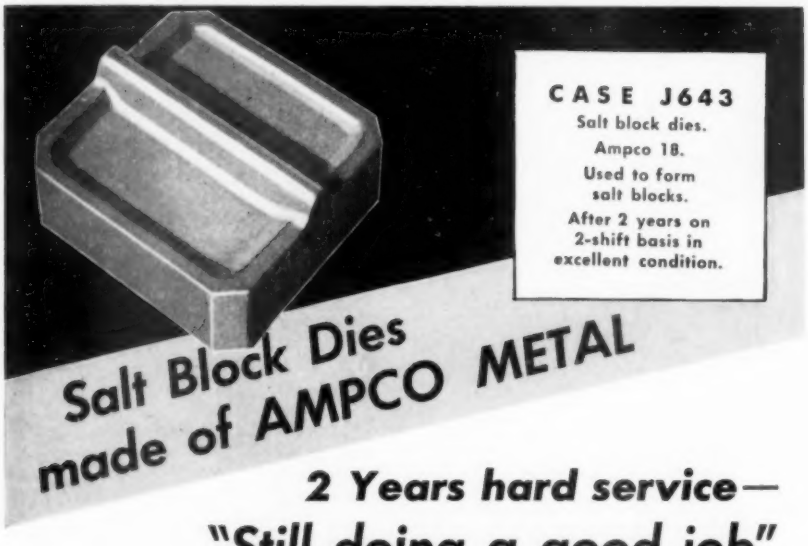
Well, investigation should bring out the facts, and without prejudice. There is, however, the implication that a profession with extremely high ethical standards may be impugned because of omissions or commissions by a few. We can't have that. If there must be investigation, and charges, then let accused engineers be tried by a jury of engineers, just as lapsed jurists are tried by their peers — by men who know the facts. Just that, or the body of consultants may suffer from occasional accusations that, however groundless, may be as damaging to reputations as though they were true. It is also essential, for the good of the game, that chiselers be weeded out. A jury of engineers would take care of that.

▲ ▲ ▲

Whatever his faults—and it's human to err — President Roosevelt's "good neighbor" policy toward Latin America ranks him as our No. 1 diplomat. We've a lot of handicaps to hurdle in our race for Pan-American good will, and the men delegated to the job — as Welles and Rockefeller — are eminently qualified for their ambassadorial duties. Now, if the Prex would only delegate someone to win over the Finns who really know those doughty but war-weary friendly enemies, we might win them over to our side. You see, the Finns aren't really pro-Axis; they're plenty pro-Finnish and caught between the devil and the deep blue sea.

Threatening to break off relations, as currently rumored, isn't going to win them over. It'll just make 'em set the tighter. Y'know, there's no one any more honest than the average Finn, but by the same token there's none so stubborn once he's set his course. You can't push him nohow, but you can lead him if the trail ahead shows promise of a desired goal. Well then, what

(Concluded on page 196)



Salt Block Dies made of AMPCO METAL

2 Years hard service—
"Still doing a good job"

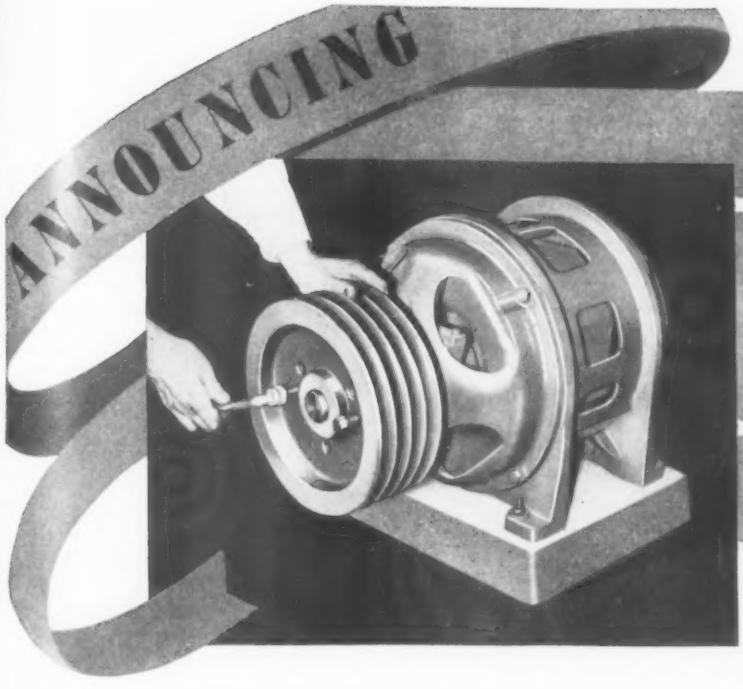
The corrosive action of salt—its abrasive effect on forming dies — the tremendous pressures needed in forming salt blocks — all combine to make ordinary salt block dies short-lived. But when one prominent manufacturer tried dies of Ampco Metal Grade 18, replacement problems were solved. "After two years on a 2-shift basis the dies were still satisfactory — good for many months of hard service," reports this manufacturer.

This experience has been oft repeated. Ampco Metal, that sturdy alloy of the aluminum bronze class, steps in and outperforms ordinary bronzes — not only in salt block die service, but as parts for machine tools, aircraft, ordnance, and other equipment. Ampco Metal stands up against wear, fatigue, and abuse.

Investigate this amazing bronze which delivers performance that is a credit to your selection. Ask for "File 41 — Engineering Data Sheets." Write today.

AMPCO METAL, INC.
DEPARTMENT TE-6 MILWAUKEE, WISCONSIN

AMPCO METAL
AMPCO
THE METAL WITHOUT AN EQUAL



PYOTT

QUICK DETACHABLE QD

SHEAVES

STANDARDIZED "Q-D SIZES"
AT NO INCREASE IN PRICE

Save Time and Labor for Machinery Manufacturers

QUICK AND EASY TO INSTALL—OR REMOVE

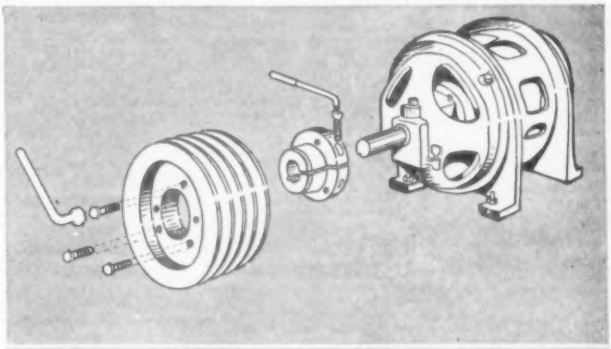
...in minutes, instead of hours!

NOW, machinery manufacturers can enjoy the many advantages of Q-D Sheaves and add sales appeal to their product without increasing their costs—in fact, in many instances, effect substantial savings.

The speed with which Pyott Q-D Sheaves can be assembled for test runs—and disassembled for shipment is of tremendous importance. And, as the hub may be left on the shaft, the user is assured of an accurate pre-aligned V-Drive.

Other advantages from the user's standpoint include: a positive fit on shaft; no weave or wobble; quick changes of sheaves for seasonal needs for different speeds without requiring a variable speed motor; no battered motor bearings or damaged sheaves as the result of mounting or dismounting operations.

No change in engineering is necessary to switch from standard sheaves and bushings to Pyott Q-D Sheaves—and you pay no premium for standardized "Q-D sizes."



Simple as A-B-C

A Slip split hub on shaft in line with keyway. Tighten clamping cap screw which anchors hub immovably to shaft.

B Slip sheave on tapered hub in line with bolt holes. Insert pull-up bolts and tighten, which provides a tapered friction drive assembly and a positive press fit on shaft.

C To remove, unscrew pull-up bolts and insert two in tapped holes in rim of sheave. Turn down and the bolts pressing against hub act as jack screws, loosen the sheave until it can be slipped off.

PYOTT

FOUNDRY & MACHINE CO.
328 North Sangamon Street, Chicago, Illinois

SPROCKETS, GEARS, PULLEYS, SHEAVES
CAST IRON AND SEMI-STEEL FOUNDRY WORK

(Concluded from page 194)

do the Finns want? Just what you and I want, and what our boys are fighting for — national integrity and security of home. The Reds threatened that when they invaded Finland. Knowing the facts, I'm not exactly blaming the Reds — they were just out to stymie Hitler — but then, there are few of us who blame the Finns for defending themselves.

A while back, it seemed as if the Reds would be amenable to a truce with Finland, but it seems that they're stubborn, too. (At least, Hitler thinks so) But, if the Reds could be induced to respect Finnish territorial rights — and they have a habit of keeping their word — and if Messrs. Roosevelt and Churchill, through the proper agents, could convince the Finns that their national salvation rested, with the Allied Nations . . . , well, they're not that stubborn that they won't see daylight through a ladder. And then, with the north clear! — but that might be a military secret, like the charted courses to the second front(s) blazoned all over the newspapers and which Hitler ain't supposed to know anything about. As for me, I want our boys to take the safest road to Berlin, and that road is the land way, not the sea way. And that's all for now, this line using up my space to the last •

Your job isn't done these days unless your products get where they're needed . . . *safe* and *fast!* That's why you need SKILSAW now to speed up sawing . . . to build better crates for parts, sub-assemblies and heavy machinery *quicker* . . . to save time cutting lumber for skids and special cradles for ocean shipment of engines, wings and gasoline tanks.

SKILSAW is light, compact, powerful . . . easy to use on every sawing job. With SKILSAW in your receiving rooms, you'll speed uncrating, too, and salvage crating lumber for your own use. Ask your distributor to demonstrate SKILSAW *today!*

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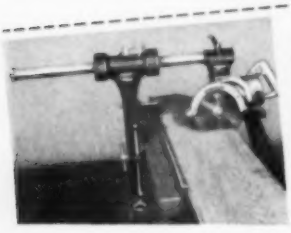
SKILSAW PORTABLE ELECTRIC TOOLS

★ MAKE AMERICA'S HANDS MORE PRODUCTIVE ★



Skilsaw Radial Arm Speeds "Gang-Cutting"

• You can saw crating lumber even quicker by "gang-cutting" with SKILSAW in the Sliding Radial Arm. Swiftly sizes wood to uniform widths and lengths for pre-fabricating boxes, crates, cradles and skids.

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A FORGING HAMMER TENDS TO DESTROY ITSELF
• • • MAINTENANCE IS IMPORTANT • • •

CHAMBERSBURG PE

Currently, hammers are so constructed that the inevitable movement of one part with relation to others is guided so as not to disturb alignment. The frames, for instance, are seated on the anvil in such a manner that any reacting movement is vertical and still parallel, and that at the end of the movement the frames will be firmly seated again upon the anvil. While this movement is practically imperceptible to the eye and to touch, it occurs at every forceful blow. Appreciation of such reaction will give a clear understanding of the purpose of the inspections recommended later.

ANVIL

MAINTENANCE

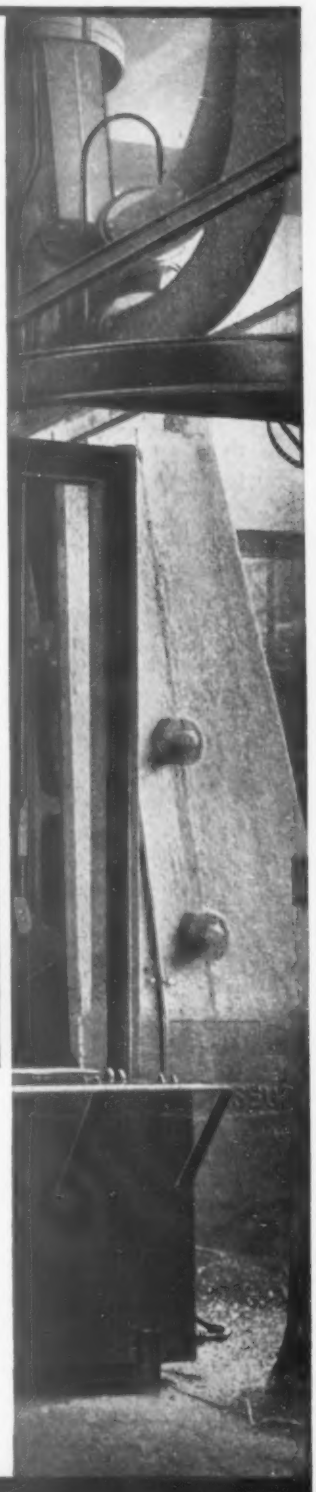
In operation, care is necessary in protecting the anvil against the forces of expansion and contraction due to thermal changes. The following points cover the major considerations:

1. The practice of allowing hot forgings to pile up against the rear of an anvil, now rarely seen, will rapidly expand the anvil. To maintain a fit, the operator tightens the anvil cap key. When the forgings are removed and cooling occurs, an anvil so abused will generally split. When forgings are "cut off" and so impelled back of the anvil, a steel plate, leaned against the anvil so as to provide a generous air space, will permit accumulation of forgings without hazard to the anvil.
2. The failure to loosen anvil cap keys at the end of runs will wise induce cracked anvils. The key should be loosened [illegible] idle time will allow the anvil to cool and contract.
3. Upset anvil cap keys which bear only against the driven end will start local fractures which rapidly spread. Upset keys should be replaced.
4. Occasionally, anvil cap keys freeze in place and must be burned out with a torch. The key is exposed and a groove should be burned down the center of the key in such manner that the walls of the key are not burned. Precautions against burning the anvil or heating it too much are necessary.
5. Redressing of the anvil cap seat should be done when each cap is replaced. No two caps will deform the same way and the redressing will increase cap and anvil life. Tool marks must not result from redressing.
6. When redressing frame seats alignment must be preserved and tool marks avoided.
7. It is best, when an anvil is removed from its foundation, that the timbers be renewed also.

Lubrication instructions should be followed to secure the maximum life of the frame seats. Care should be taken to remove scale from lubricator attachments before applying grease.

To further preserve the frame and anvil seats Chambersburg Hammers are provided with breather holes. Thus, when shock opens such joints clean air is sucked into the space rather than the scale laden atmosphere near the joint. The breather holes therefore must be kept clean. Their effectiveness may be tested with a flame at the opening as a blow is struck.

2



Whether you operate one or a dozen hammers . . . whether they are 2500 lbs. or 25,000 lbs. falling weight . . . proper maintenance will do much to lengthen their productive life . . . and to insure accurate, close-to-finish forgings. There are some valuable suggestions applicable to any make of hammer in Chambersburg's Model "E" Steam Drop Hammer Maintenance Book. A copy will be mailed on request.

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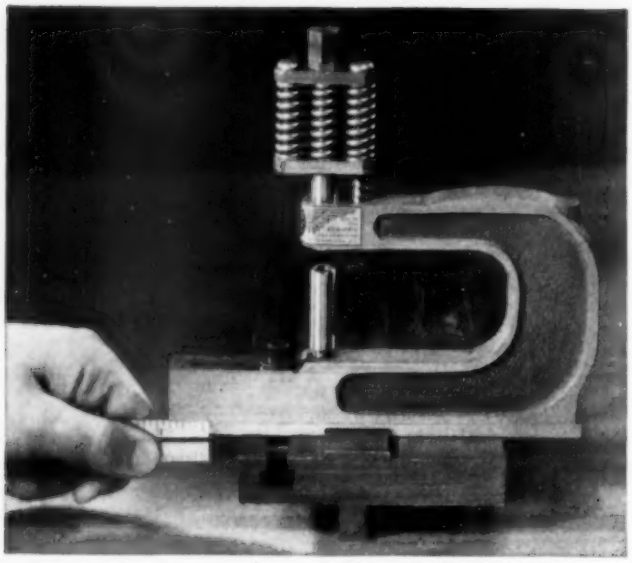
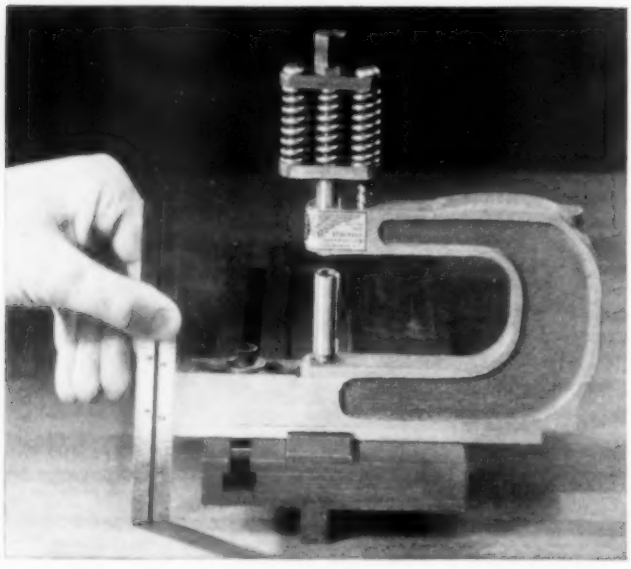


ABOVE: Wales Type "CA" Hole Punching Unit moved maximum distance forward on built-in adjustable adapter.



ABOVE: Showing unit centered by lining up front of holder flush with adapter plate.
BELOW: Unit moved maximum distance back. Note simplicity of locating by measuring with scale.

Announcing the New WALES *Type "AC"*

HOLE PUNCHING UNITS with Adjustable Front to Back Adapters FOR STAGGERED HOLES

5 NEW FEATURES

1. May be located on standard rails between present units wherever required.
2. Die height and shut height same as Type "C" Units.
3. Standard punches, dies and stripping guides are used.
4. ¾" adjustment front or back of center line.
5. Special adapters made to suit any requirement.

"There's Always Something New in the Wales Line." Write for Catalog CA.

WALES - STRIPPIT CORP.

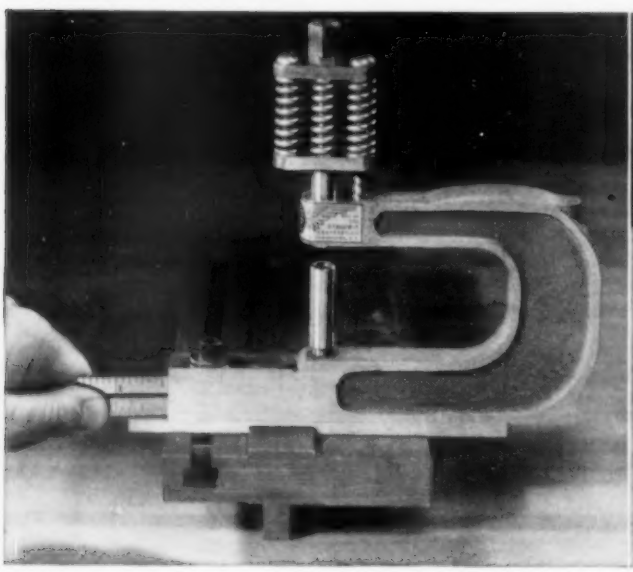
(Formerly The Strippit Corporation)

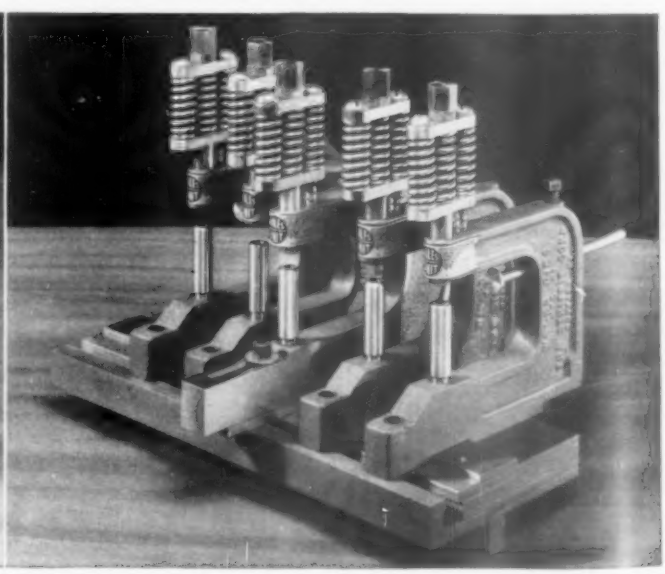
North Tonawanda, N. Y.

GEORGE F. WALES, *President*

Specialists in Punching and Notching Equipment

BELOW: Showing Wales Type "CA" and "C" Hole Punching Units in set-up on press brake rail. Center unit (Type "CA") with built-in adjustable adapter punches holes forward or backward of the straight line pattern produced by the other four Type "C" Units.





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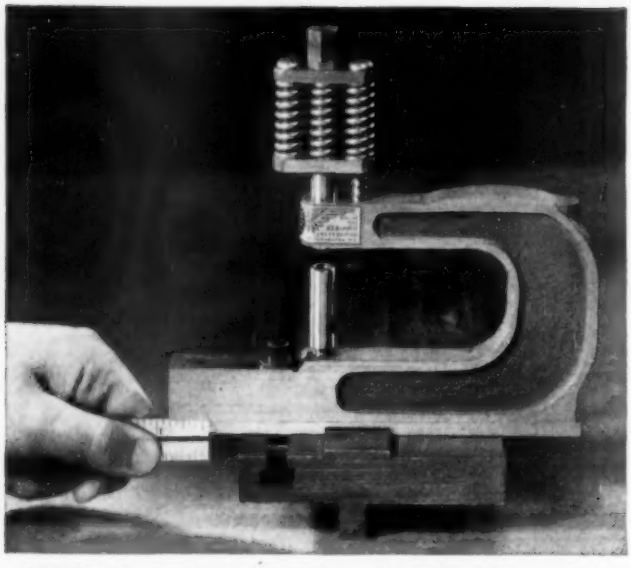
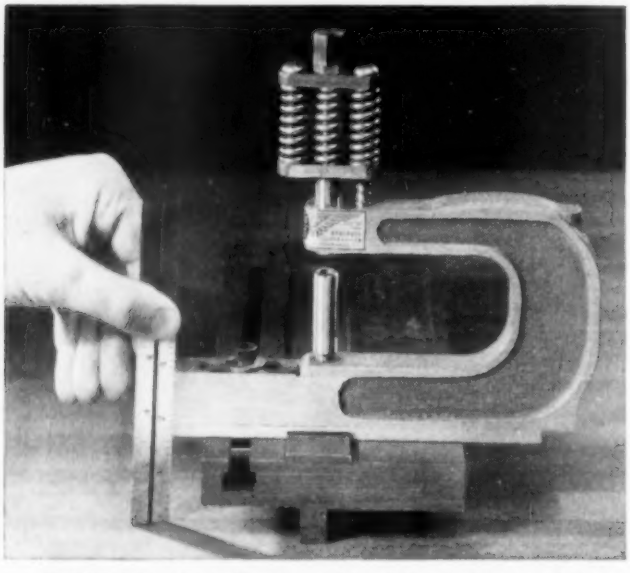


ABOVE: Wales Type "CA" Hole Punching Unit moved maximum distance forward on built-in adjustable adapter.



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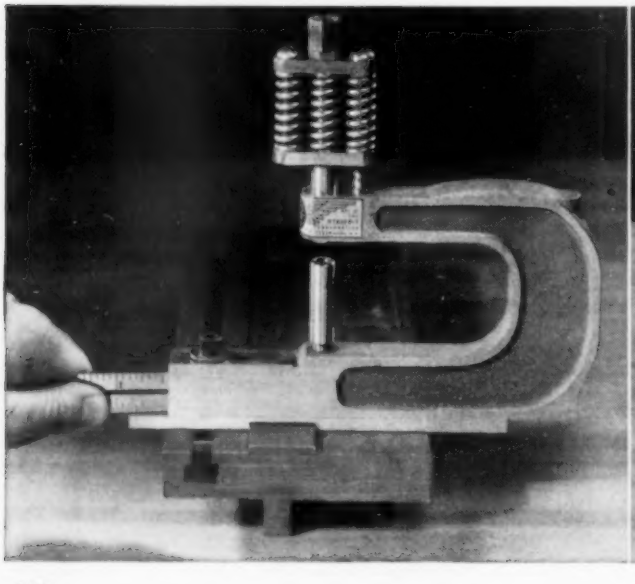
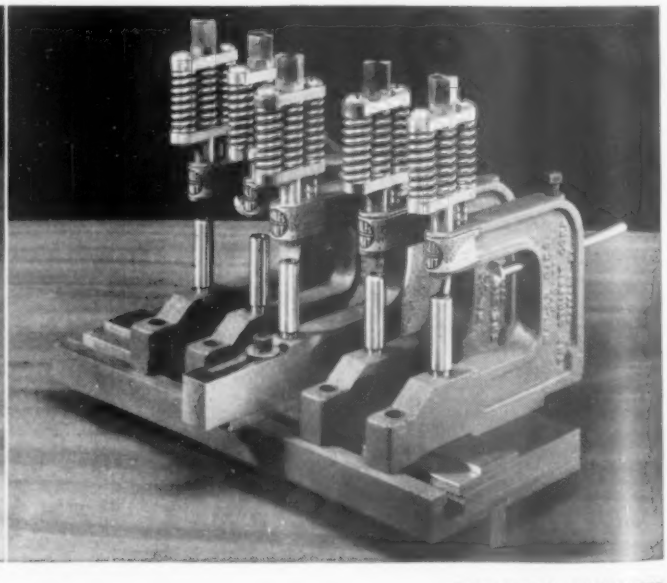
Specialists in Punching and Notching Equipment

BELOW: Showing Wales Type "CA" and "C" Hole Punching Units in set-up on press brake rail. Center unit (Type "CA") with built-in adjustable adapter punches holes forward or backward of the straight line pattern produced by the other four Type "C" Units.





AMERICAN SOCIETY OF TOOL ENGINEERS

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●Senior initiation fee is five dollars. Dues eight dollars per year for senior grade membership and five dollars per year for junior grade membership. Junior initiation fee is two dollars.

A. S. T. E. DOINGS

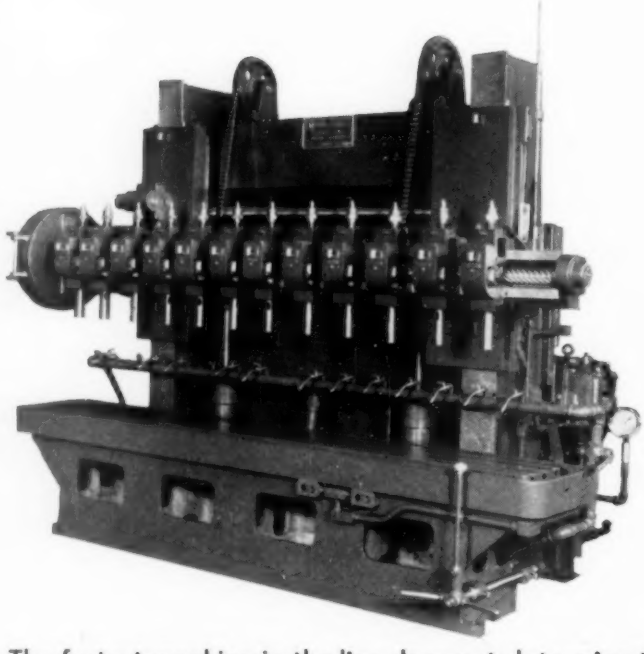
Akron. Mr. F. O. Hoagland, master mechanic of the Pratt & Whitney Company, was the principal speaker at the May 18th meeting held at the Hotel Akron. Mr. Hoagland spoke on the subject of Jig Boring and some of the problems connected therewith.

Binghamton. Over one hundred members and guests attended the May 5th meeting held at the Hotel Sherwood.

The technical part of the meeting featured talks by Mr. J. W. Quick and Mr. Ivan Kessler of R. C. A. Mfg. Co. Mr. Kessler presented an analytical discussion of the subject "Machinery and Employment." He also introduced J. W. Quig, manufacturing methods engineer of R. C. A., who discussed the manufacturing methods and developments carried on by the R. C. A. in producing high production through better tools and motion economy.

Mr. Quick compared old manufacturing methods and new methods developed in R. C. A. He used motion pictures to illustrate his talk.

What Causes Increased Production?



• The fastest machine in the line does not determine the production rate—but, if faster machines are not placed in the production line, the rate never can rise.

Replacement of the slowest machine with one which performs more rapidly will permit the whole line to produce faster.

The HF64 hydraulic, rail feed, straight line drilling machine is one of many machines designed by Moline Tool Company to help in boosting production rates. This machine will drive sixteen ¾-inch drills, or thirty-two ⅜-inch drills in low carbon steel, or an equivalent load in other materials.

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MOLINE TOOL COMPANY

MOLINE, ILLINOIS ***Cable Address: "Holehog" Moline*** **ESTABLISHED 1901**

Bridgeport (Fairfield County). The May 12th meeting was held at the American Legion Hall. Members and guests heard Mr. William Nardo of the American Tool Engineering Company who talked on "Process Engineering and Tolerance Control."

Mr. Ken Thomas, area vice-chairman of public relations, gave a talk and showed Vought-Sikorsky's new film on "Helicopters."

The April 14th meeting was held at the Yale & Towne Manufacturing Company in Stamford. Mr. Dalton and Mr. Hoyt, general superintendent and general manager respectively of the Yale & Towne Mfg. Co., welcomed the members of the Society to the Yale & Towne Auditorium.

The main speaker at this meeting was Mr. Frank Curtis, chief engineer of the Van Norman Machine Tool Company, who spoke on "Tool Engineering and its Relation to Production Economy," and "Induction Heat Treating."

Buffalo. The Buffalo-Niagara Frontier Chapter held its Executive meeting on May 5th at the Lafayette Hotel. The main subject discussed at this meeting was a selection of subjects for programs for the coming year.

Chicago. Sixteen new members were introduced by membership chairman, Frank Armstrong, at the May 3 meetdenting held at Hyler's Restaurant.

The two hundred and fifty members and guests heard the national president of the Society, Mr. Ray H. Morris, who spoke on the national problems confronting the Society.

The speaker at this meeting was Mr. A. Bradford Reed, president of the Rolled Thread Die Company. Mr. Reed spoke on the subject of "Development of Precision Thread Rolling."

Cleveland. The final meeting of the season was held on May 14 at the Mid-Day Club. Approximately one hundred and forty members and guests were present.

The speaker at the technical session was Mr. J. B. Wilkie, engineer with Pratt & Whitney, who spoke on the subject "Modern Gage Practice." The speaker outlined the need for gages and pointed out that the demands for gages far exceeded the ability to produce in such a great emergency. By means of slides the speaker illustrated the various kinds of gages, pointed out the proper care and use, showed the use of gages in manufacturing and stressed the accuracies possible.

(Continued on page 202)

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America's First Transparent Sulphurized Cutting Oil

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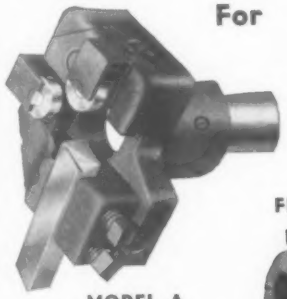
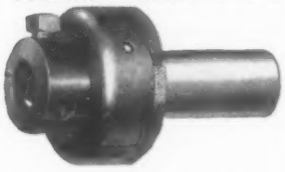


MODEL A
FOR TURNING

MODEL D
FLOATING TOOL HOLDER



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WRITE FOR LITERATURE

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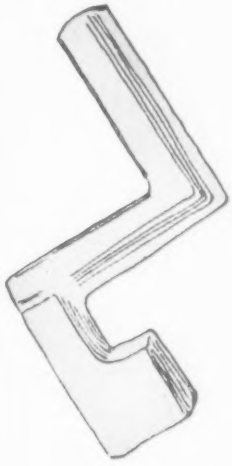
Flexible Abrasive Belt reaches spots a snagging wheel cannot touch on this casting.



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Jumps production, even with semi-skilled workers

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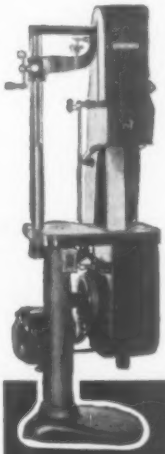
Backed by a suitably shaped platen, the belt can surface identical parts by repeat operations on an efficient production-line basis. With a true-flat platen, plane surfaces can be finished accurately. Combination platens permit surfacing flats and curves at the same time on one machine.



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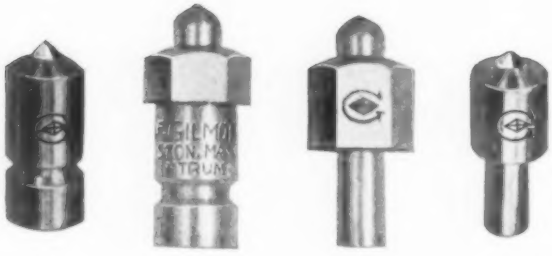

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—— A. S. T. E. DOING ——

A recent Buffalo meeting honored incoming and outgoing officers of the chapter. In the picture, front row left to right, are T. R. Goldsmith, F. R. Wilson, F. S. Schwenzer, W. J. Gamble, Otto Winter, H. C. Taylor, F. S. McCoy and A. F. Kirchgessner. Second row left to right are H. Richardson, J. Don Reep, A. C. Siegel, H. K. Rose, Clyde Lucas, A. Christensen, George Keller, C. Leavy, W. Noth and A. Dayman.

•

Columbus. Major C. A. Hudson, Assistant Chief of the Ordnance Branch, Fifth Service Command, spoke at the May 11th meeting of the Columbus Chapter which was held in the Gold Room of the Hotel Fort Hayes. The Major presented a paper on "Ordnance Supplies."

Earl Johnson, national secretary of the Society, also spoke at this meeting. Mr. Johnson gave a short talk relative to the quality rather than quantity of new members being accepted.

Dallas (North Texas). The April 23rd meeting, held at the Jefferson Hotel, featured talks by Glenn Periman, superintendent of North American Aviation and Mr. H. F. Schwedes, factory manager at North American. Mr. Periman gave a talk on "Tool Design" while Mr. Schwedes showed a production film of one of the airplants they produced at the North American Dallas plant.

A business meeting was held April 6th at the Jefferson Hotel, the purpose of which was to appoint committee chairmen for the coming year.

Appointments included George Perkins and P. D. Brown who will assist co-chairmen who serve on the Program Committee; Walt Frazier, R. L. Ferrucci, and J. W. Harrison, Membership Committee; Walt Theis, Entertainment Committee; Claude Wilson, Publicity Committee; and Frederick Lenzen, Industrial Relations Committee.

Dayton. The one hundred seventy-five members and guests of the Dayton Chapter met on May 10, at the "Silver Forest" Miami Hotel. They heard Mr. Frank Ireland, General Manager of Delco Products, who spoke on "Sabotage."

This meeting honored the newly elected officers of the Chapter. Past chairman, George Goodwin presented the new chairman, Jack Blair with the Chapter charter. Earl Johnson, national secretary of the Society, was presented the past chairman pin by chairman Blair who in turn received a present chairman pin from Mr. Johnson.

Publicity chairman, J. R. Meyers, spoke briefly on the chapter's "Year Book" coming out soon.

Decatur. About 150 members and guests attended the May 5th meeting held at the Hotel Orlando. They heard Dr. H. B. Osborn, research and development engineer, Tocco Division, Ohio Crankshaft Company, Cleveland, who was the main speaker at this meeting. Dr.

(Continued on page 204)

STURTEVANT QUALITY

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No Elaborate Setting Up—test platform adjusted for test length of spring by merely revolving on threaded vernier scale. Can be adjusted in a few seconds to within .003".

Anyone Can Operate—operator places spring on platform, pulls down on wrench handle until **tone device sounds** taking reading at that point from scale on wrench. Only one scale to watch.

STURTEVANT Spring Testers are so engineered, designed and individually set that each is inherently **accurate**; hence readings will be as accurate as the torque wrench used. Sturdily built — no fragile springs, glass dials, or moving parts.

Low Cost—makes STURTEVANT Testers practical not only for test laboratories but for general inspection use thruout plant, and for accurately matching springs, as sets of valve springs, etc.

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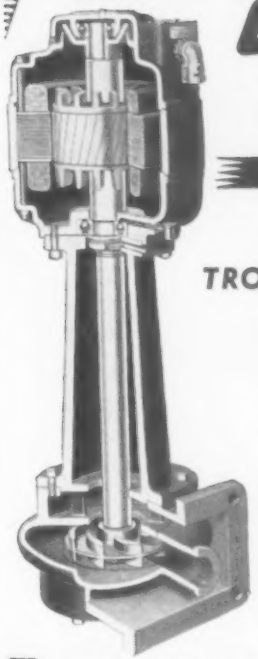

GIVE SPEEDY, TROUBLE-FREE OPERATION

Reduce "absenteeism" for your machines by equipping them with Gusher Coolant Pumps. Sturdy vertical shaft, double suction intake and built-in motor make "Gushers" dependable and trouble-free. Split-second control gives you copious flow of coolant, when you want it—where you want it. Write for data and specifications.

This is an internal discharge type. No outside piping necessary.

THE RUTHMAN MACHINERY CO.

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LARGEST EXCLUSIVE BUILDERS OF COOLANT PUMPS

EVERY AMERICAN TOOL HOLDER HOLDS

3 IN 4

BIT SIZES POSITIONS

Each of the four sizes of American Tool Holders will hold three sizes of bits in four positions. This range meets all requirements of tool room lathes on light, precision cuts. American Holders have a wide, positive grip which prevents tool breakage and enhances the accuracy of the lathe itself. The line drawing illustrates the four positions—all available in a few seconds by loosening and tightening a single bolt.

MAIL THE COUPON TODAY

Please send complete information on the four standard sizes of American Tool Holders

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BLAKE TAP GRINDERS — FILTAIRE PORTABLE DUST COLLECTORS — AMERICAN TOOL HOLDERS — BLACK DIAMOND PRECISION DRILL GRINDERS — L & D HIGH SPEED DRILL PRESSES

Osborn spoke on "Induction Heating as Applied to Forgings, Castings or Hardening." The talk was illustrated with picture slides and free-hand blackboard illustrations.

Elmira. The May 3 meeting featured a talk by C. M. Ripley, world traveler, engineer and lecturer for the General Electric Company. Mr. Ripley's talk was entitled "Power For War" and outlined the vital part played by America's electrical industry.

The 350 members and guests present at this meeting and dinner witnessed the presentation of past chairman's pins to J. Raymond Blank, John R. Lynch, C. D. Thomas and M. Hugh Evans by national executive secretary Adrian L. Potter. Chairman Dolph Kyler was presented a chairman's pin.

It was announced at this meeting that during the last season, membership in this chapter increased 40 per cent and meeting attendance had increased 300 per cent.

Fond du Lac. May 14 was "Oshkosh Night" with a dinner and technical session held at Hotel Athearn, Oshkosh. The newly elected chapter chairman, Arthur F. Schroeder, presided at this meeting which was attended by members and guests from Oshkosh, Fond du Lac, Ripon, Sheboygan, Kaukauna, Green Bay, Neenah, Appleton, Fond du Lac, Oakfield, Milwaukee and St. Louis.

George W. Curtis, district manager, and John Welchner, metallurgist of Timken Steel & Tube Co., were guest speakers. They discussed "Cemented High Speed Steel Tips," and used a moving picture to illustrate their talk.

For the interest of the fishermen present, a color film of "Fishing Hints" was presented.

Fort Wayne. The May 12 meeting, held at the Chamber of Commerce, featured two technical speakers.

The first speaker was Mr. Axel Lundbye, chief engineer for the Crowell-Collier Publishing Company. Mr. Lundbye spoke on the subject of "Chrome Plating for Increasing Tool Life." Tools which had been subjected to this treatment were on display at the meeting.

The second speaker was Mr. Victor H. Erickson, sales engineer for the Norton Company of Worcester, Mass. Mr. Erickson spoke on "The Use and Care of Grinding Wheels and Grinding Chrome Plated Parts." The various types of grinding on cutters and tool bits were illustrated by slides. A sound film was also shown entitled "Cylindrical Grinding."

Grand Rapids (Western Michigan). New Chapter officers and committee chairmen were introduced at the April 12 meeting which was held at the Park Church in Grand Rapids.

Following a report of H. E. Goodfellow on the national convention in Milwaukee, Chairman Hoogerhyde presented Mr. M. Wilson McFarlin from the Grand Rapids F. B. I. Office who spoke on the formation and work of the F. B. I.

The main speaker of the evening was Mr. Roy E. Bender, superintendent of Trades Training at the Thompson Aircraft Products Corporation, Cleveland. Outlining the methods he used to engage and train help at this plant, Mr. Bender augmented his explanation with charts illustrating how applicants are sifted out and trained for a particular job. Mr. Bender presented movies on the type of work done at his company's plant and on the procedure of inducting new employees into the plant.

Hamilton. The Welland House at St. Catherines was the scene of the April 9 meeting and was attended by approximately 130 members and guests. Those present heard Mr. A. J. Fuller, engineer in charge of research at the Jones and Lamson Machine Company. Mr. Fuller gave a talk on "Inspection by Projection" which was illustrated with slides.

Five new members were introduced at this meeting.

This chapter held an executive meeting on April 26 at the office of Atlas Steels, Ltd., Hamilton.

Hartford. The May 3 meeting was held at the City Club with Mr. H. L. Pope of the Cincinnati Milling Machine Co. as the principal speaker. Mr. Pope spoke on surface broaching, the design of the broaches and some of the holding means produced by his company. He showed pictures of single and duplex

(Continued on page 206)

1. *Tools easily honed—kept highly polished—before each shift or with tool in machine—cuts down on carbide-tool grinding.*
2. *Keeping tools sharp saves set-up time in changing to new tools, speeds machine output and reduces work spoilage.*
3. *Tamaloy Hones are long-lasting. Diamonds set in tungsten carbide resist wear. Carbide matrix prevents diamonds from falling out when rubbed against hard surface or edge.*
4. *Supplied in three grades—rough, medium and fine or 100, 150 and 200 grit.*

Ask for prices and other details

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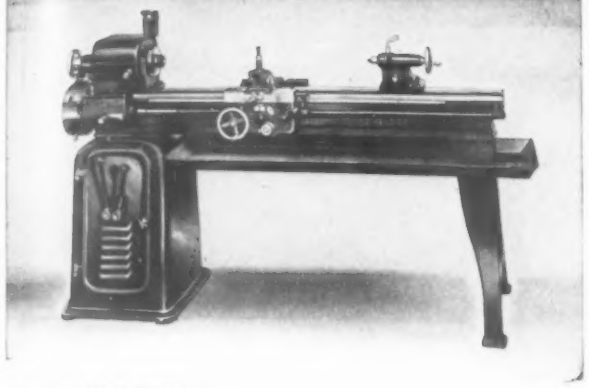
65 COLDEN STREET, NEWARK, N. J. formerly Circle Tip Tool Co.

SHELDON



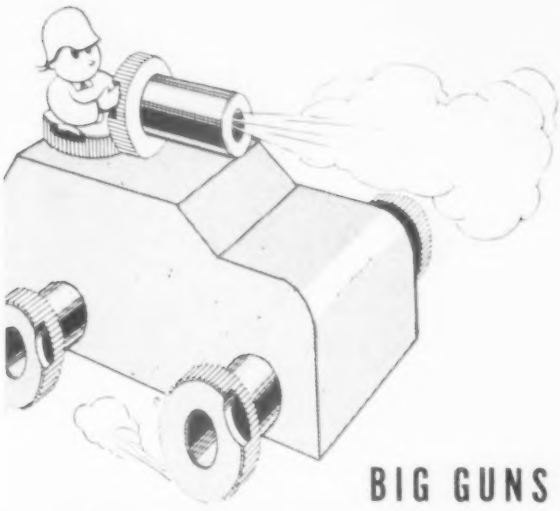
SHELDON BBU-1240 WQ

Precision Lathe

★ This quality 12 in. ball bearing tool room lathe is built for precision work and will retain its accuracy under long and hard usage. It has extra collet capacity (to 1" round), the finest precision ball or roller bearings obtainable, an improved heavy-duty, double wall apron with power cross feed; full quick change gears and full bowl headstock. Its improved Sheldon 4-speed V-belt, lever-clutch operated, underneath motor drive is entirely enclosed in the pedestal leg and has anti-friction bearings. It is so designed that spindle belts operate thru a standard 1-piece bed. This bed is bridge-braced with heavy cross girts and has hand scraped ways—2 V-ways and 2 flat ways.

★ If interested in 10", 11" and 12" quality lathes be sure to see the SHELDON.

SHELDON MACHINE COMPANY, INC.
4252 N. Knox Ave. Chicago, U. S. A.



BIG GUNS FOR DRILLING HOLES

They're mighty small compared to a gun or a General Grant, but in building jigs for the manufacture of gun and tank parts or any other precision metal part it pays to use Universal Drill Bushings. Because of their straight and round superfinished bores, Universal Bushings save tools, wear longer and assure accuracy. Write for complete facts.

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• Drilling • Grinding • Slotting
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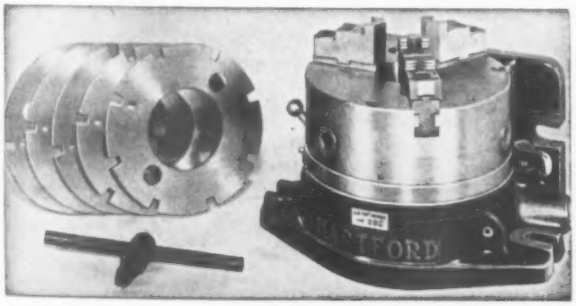

Perfect indexing is done by this machine attachment — even the hands of unskilled operators. Adaptable to milling, drilling, grinding, planing, slotting, and jig boring operations, the "SUPER-SPACER" is pictured above with standard equipment of mask plates, reversible jaw, self-centering chuck, and sliding handle chuck wrench.

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HARTFORD, CONN.

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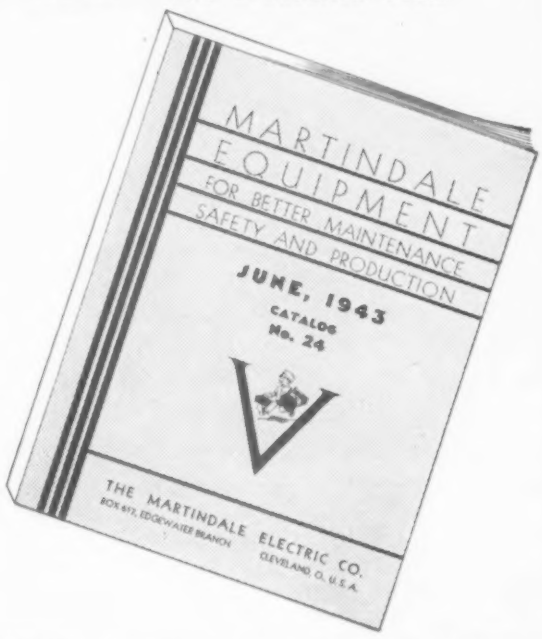

Electrical Maintenance Equipment including Commstones, Undercutters, Mica Saws. Also includes Rotary Files and Burs, Screw Slotting Saws and Safety Equipment.
Write for a copy of this No. 24 Catalog.

THE MARTINDALE ELECTRIC CO.
1421 HIRD AVE. CLEVELAND, OHIO

ram type surface broaching machines.

During the short business meeting, Ed Morancey gave the treasurer's report. Mr. A. H. d'Arcambal told of a personal membership drive which has netted 12 applications from a group at Hartford.

Indianapolis. Seventy-five members were present at the April 29th meeting which was held in the Chateau Room of the Claypool Hotel. They heard the principal speaker of the evening Mr. Phillip McKenna of the McKenna Metal Company. Mr. McKenna gave a talk on the making, grinding and use of Sintered Tantalum Carbide Tools.

Mr. R. E. Strallum, district manager of the War Training Courses at Purdue University Extension, made an announcement at this meeting of the availability of these courses.

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A meeting of the chapter's executive committee preceded the dinner of this May 5th meeting.

Milwaukee. The technical meeting which was held at the Astor Hotel on May 13 was preceded by a dinner in the Venetian Room. Program Chairman Lawrence Radermacher introduced the speaker of the evening, Mr. A. Gabriel, president of the Acme Industrial Company. Mr. Gabriel's discussion was on the science of measuring with light waves and its application in current industrial practice for measuring gages and other precise work.

Foster Koehn, chairman of the entertainment committee, reported on the coming June frolic.

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(Continued on page 208)

DETROIT DIE SETS ★

STANDARD

DIE SETS and ACCESSORIES

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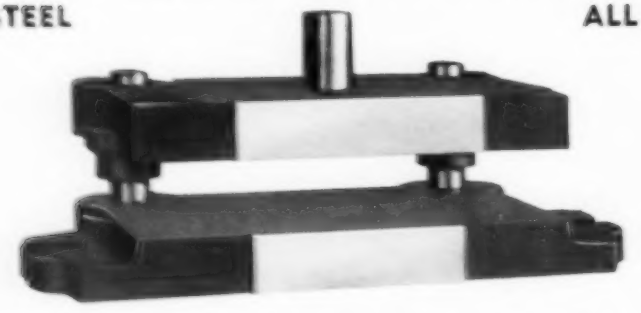

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Cap Screws
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More Cuts per Minute at Less Cost per Month

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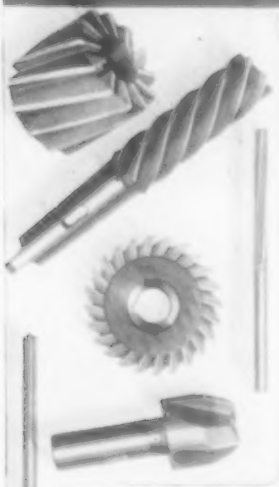

• A.C.E.'s long-wearing cutting tools are the result of careful study of customers' cutting needs and expert workmanship. Each tool is given complete and thorough inspection at all stages by an inspection department organized as a separate unit. This has resulted in a minimum of rejects.

Making Special Cutting Tools (we make none for stock) it has been difficult at times to keep up with the ever increasing demand for tools of our quality. However, modern methods and long experience have enabled us to handle the many set-ups required at almost mass production speed.

Send us your urgent inquiries on round work—we will send estimates promptly. Illustrated bulletin on request.

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This straight tail grinder dog

is especially desirable for use on cylindrical grinders of various makes, comes in four sizes and thus will accommodate any diameter from 1/4 inch to 6 inches. There is but one screw to be operated and work can be handled as quickly as with any single screw dog. They have brass faces and brass-tipped set screws.

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585 IRANISTAN AVE.

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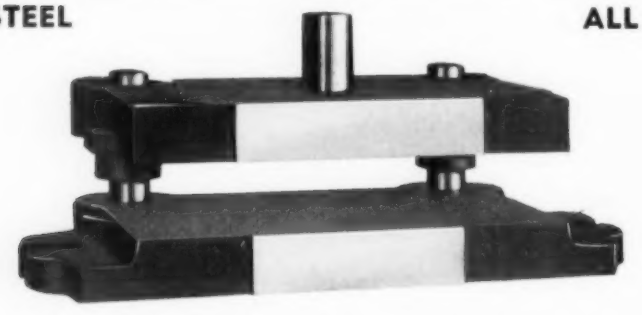

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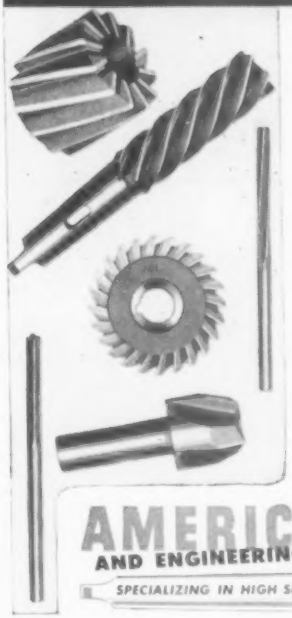

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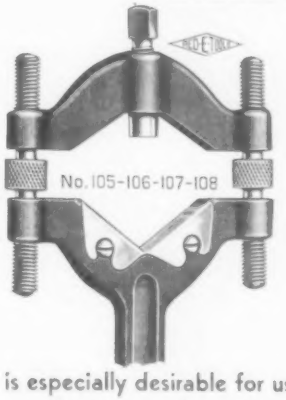

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BRIDGEPORT CONN.

Pittsburgh. A large attendance of members and guests turned out at the May 7 meeting in the Hotel Henry to hear Mr. John A. Harrington, president of the Savage Tool Company. Mr. Harrington spoke on "Low Temperature Refrigeration in Practical Use." Mr. Harrington brought out the benefits obtained by cooling metals below freezing and cited the short length of time now needed to age and stabilize certain metal parts over that formerly required.

Another speaker at this technical session was Mr. H. R. Roberts of the Deep Freeze Division of Motor Products Corporation. His talk included a description of some machines used to remove heat or deep freeze metal parts.

Providence. The little Rhody chapter held its May 24 meeting at Howard Johnson's restaurant. The coffee speaker was Mr. A. J. Zino, Jr., of E. F. Houghton & Co. Mr. Zino spoke on "Cutting Fluids, Their Composition and Functions."

Included on the program at this meeting was a Navy film on submarines and a talk by a Navy Public Relations officer.

Rochester. Eighty members and guests attended the May 12 meeting which was held at the Hotel Sagamore Roof Garden. This meeting was designated as Past Chairmen's Night and past Chairmen John Bartek, Charles Codd, John Dense, Cecil Lucas and Clifford Sears were honored.

Earle De Bisschop and C. V. Briner took part in the ceremony in which pins were presented to the past chairmen.

Chapter Chairmen Joe Schick also received a chairman's pin which was presented to him by Cecil Lucas, national director. Chairman Schick introduced Prof. Wm. J. Conley of the University of Rochester and presented him with a check for $200 from the chapter to be used to further the work of Prof. Conley in educating members and others in the proper uses and treatments of metals.

Entertainment at this meeting included two movies shown by Jack Moore through the courtesy of Massey Harris Corporation. Following the movies Harry Stone and his company entertained the chapter with songs and dances.

Rockford. Julian Gromer, well known photographer and world traveler, presented an unusual natural color movie of Hawaii at the monthly dinner meeting of the Rockford chapter on May 6. The pictures were taken by Mr. Gromer on a cruise through the islands only a few weeks before the attack on Pearl Harbor.

St. Louis. Mr. John H. Staiger, metallurgical and products engineer of the LaSalle Steel Company, was the principal speaker at the May 6 meeting which was held at the Hotel Melbourne. More than 200 members heard Mr. Staiger's talk entitled "A Non-Technical Story of Steel Making."

San Francisco. The San Francisco Engineer's Club was the scene of the April 16 meeting of the Golden Gate chapter. The principal speaker at this meeting was Mr. H. T. Bauer of the Metallizing Engineering Company of Los Angeles. Mr. Bauer presented a paper on "Modern Metallizing Methods for maintenance and Production."

Chapter chairman, Walter Kassebohm, introduced Mr. Karl Bues who gave a report to the chapter on the Milwaukee convention.

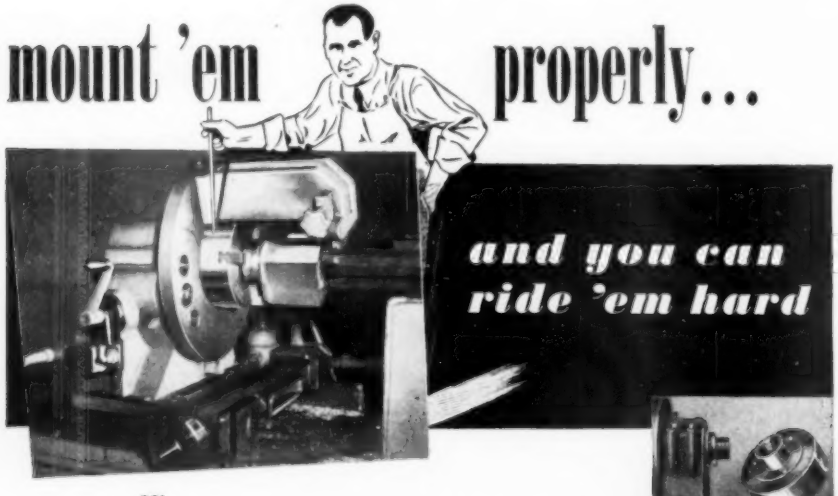
The May 11 meeting was held at the Hotel Leamington at Oakland. This was the "President's Night" meeting, with Ray H. Morris national president of the Society, principal guest and speaker. President Morris spoke on "The American Society of Tool Engineers and the War."

Also included on the program was a sound film on "Die Casting" shown by the New Jersey Zinc Sales Company and a picture on "Turret Lathes" produced by the Gisholt Machine Company.

Seattle. During the business session of the April 13 meeting which was held at Crawford's Sea Grill, chapter committee members were appointed. Appointments included Walt Ainsworth, standards committee; Ken Stadum, publicity committee; Fred Nicholson, industrial relations committee; Fred Howard, educational committee; John Goodrich, constitution and by-laws

(Continued on page 210)

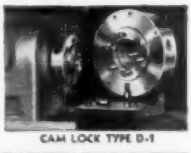
mount 'em properly...



and you can ride 'em hard

THREADED SPINDLE NOSES

AMERICAN STANDARD TYPE A-1



CAM LOCK TYPE D-1

LONG TAPER KEY DRIVE TYPE E

WHEN you mount a chuck on a machine tool spindle, you're doing a PRECISION operation . . . one that controls in a large measure the accuracy of the work that the machine tool will turn out.

Of course, with the modern, simplified, quick-mounting spindle noses such as the four standard types shown on this page, the job has been made very quick and easy. But it is still . . . in fact, even more so . . . a PRECISION operation. A few times of "slapping her on" without making sure that *all* bearing surfaces are absolutely *free* of dirt or chips . . . a few times of wrenching up tight before being properly and truly seated . . . will do damage that will plague you for evermore.

MAKE SURE EVERY OPERATOR, EVERY TIME, DOES THIS:

1. Carefully wipes clean all bearing surfaces with a soft clean cloth.

2. Takes the few extra seconds to bring chuck onto spindle slowly and carefully.

3. Tightens all bolts "progressively", first a few turns on one, then a few turns on the next, till all are uniformly tight.

4. NEVER force a chuck into position. If it doesn't "go" smoothly, something is wrong.

We are anxious to help you, not only to secure the essential chucks you need, but also to make sure that every chuck is doing its job most efficiently. We will be glad to send you reprints of this advertisement and copies of our "Chuck-Check" cards on request. The Cushman Chuck Company, Hartford, Conn.

These small cards can be given to operators or put on bulletin boards. They'll help save time, save chucks and reduce spoilage.

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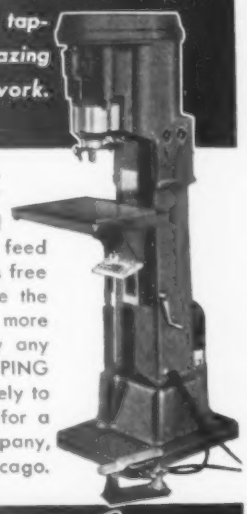

The part and the machine do the "thinking." Air does the work! Operator has only to feed parts. With both hands free—with no need to use the foot pedal—operator can turn out more work—faster and better—than by any other method. Full details in TAPPING TIPS—new literature devoted largely to critical war work. Write for a copy. R. G. Haskins Company, 2756 W. Flournoy St., Chicago.

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TEAM WORK—

Close co-ordination of the Allied armies enabled them to win the battle of Africa.

Similarly, co-ordination of the makers and users of tool steel will help win the battle of production.

It pays to use Good Tool Steel.

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LIGHT WEIGHT PLASTIC HANDLES give gages more sensitive touch because they are lighter than any metal. They reduce fatigue and insulate gages from bodily heat, safeguarding accuracy.

EASILY MARKED for identification with the same stamps used for marking metal handles.

LOW COST represents a real saving.

IMMEDIATELY AVAILABLE IN 6 STANDARD SIZES and in any quantity.

MADE IN FOUR COLORS, Red, Yellow, Green, Black for quick identification of types or sizes.

IDEAL FOR THE NEW GLASS GAGES. Users and makers find that gages of glass require a lighter than metal handle. This lightness reduces the danger of breakage and also adds to the sensitivity.

FEDERAL TOOL CORPORATION

402 North Leavitt Street Chicago, Illinois

committee; John Fellows, editorial committee; Conrad Matson, Membership committee; By Hartley, ticket sales committee; Art Means, program committee; and Leon Mooradian, entertainment committee.

Nine new applications for membership were accepted at this meeting. Entertainment included a film from the Allis-Chalmers Company entitled "We Build For War and Plan For Peace."

South Bend. Mr. Albert G. Mather, president of the DoAll Mid-West Company, Chicago, was the speaker at the May 11, meeting. Speaking to the members on the Continental Process, Mr. Mather covered the subject of short runs of stampings at low die costs.

Syracuse. Mr. Clyde R. Powell, personal director of the Endicott-Johnson Corporation, was the guest speaker at the April 13 meeting held in the Industrial Club. Mr. Powell's subject was "Influencing People's Behavior."

Two motion pictures were also included on the entertainment for this meeting.

The annual dinner dance was held on May 1 in the Hotel Syracuse. 125 couples attended this semi-formal party which included favors and a floor show.

The May 11 dinner meeting was held at the Hotel Syracuse with Mr. S. A. Brandenburg of the Monarch Lathe Company as guest speaker.

Toledo. The April 20 meeting held at the Secor Hotel included installation of new chapter officers. Mr. [illegible] V. Briner, second national vice-president, and Adrian L. Potter, executive national secretary, were present at this meeting. Mr. Briner spoke on the growth of the Society and also conducted the installation ceremony.

The chapter officers installed were Claude E. Robitaille, chairman; Richard M. Hindman, vice chairman; C. A. Colwell, secretary; and Albert Hage, treasurer.

A short address was given by Ensign J. P. Lins, U. S. N. R., who spoke on the cooperation existing between the armed forces and the men who furnish the material with which to fight.

The principal speaker at this meeting was Mr. Harold H. Hartley, executive editor of the Toledo Times. Mr. Hartley's subject was "Blueprint of Tomorrow."

Wichita. The May 11 meeting was held at Hotel Broadview with Chairman M. M. Ross presiding. Chairman Ross made the following appointments for committee chairmen: Waldon Carlson, program and entertainment; Harry McCarter, membership; Otis White, standards and educational; W. Hayne, publicity and editorial; Claude Lockert, industrial relations; and R. S. Williams, constitution and by-laws.

During the technical session of this meeting, Mr. J. W. Rix gave a talk on "Forgings and Stampings." Mr. Otis White showed some slides and gave a short talk on the A. S. T. E. meeting at Milwaukee. Mr. Kearney Robinson spoke on Tooling of Aircraft Engines."

Williamsport. The speaker at the April 19 meeting, which was held at the Elk's Club, was Mr. G. M. Rohde, a representative of the War Man Power Board of Washington. Mr. Rohde gave a talk on efficiency.

Chapter chairman, Harry Taylor appointed the various committee members at this meeting. They included, J. H. Shafer, L. R. McEvilla, C. R. Winter, S. W. Matthews, L. H. Lantz, L. E. Zimmerman, C. F. Towar, K. I. Shipman and W. F. Beyer.

Worcester. The May 4 meeting was held at Putnam & Thurston's Restaurant with about 80 members and guests attending the dinner and technical session. Among the guests at this meeting was Mr. Tien Chiue Lay, graduate engineer of Peking University who is studying production methods in this country.

Mr. J. A. Rinek, flight test engineer of the Pratt & Whitney Aircraft Division, was the coffee speaker. His topic was "Aircraft Servicing."

Mr. F. O. Hoagland, master mechanic at the Pratt & Whitney plant spoke on "Jig Boring and Some of the Problems Connected Therewith."

New members, William H. Bedford, Ralph E. Rawling and Stanley A. McCaslin were introduced at this meeting and presented with A. S. T. E. pins.

THE END.

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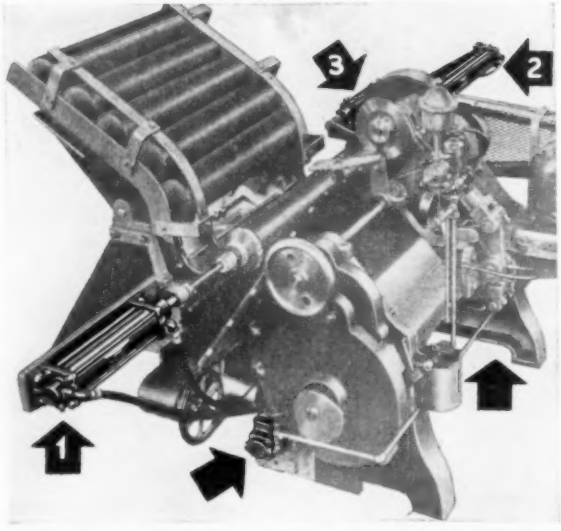
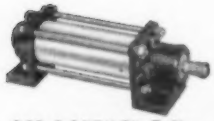
Thanks to

NOPAK

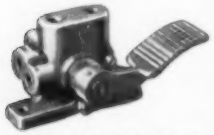
Air Valves and Cylinders



Arrows above indicate location of NOPAK Air Cylinders and Operating Valves.



3 Model "A" Air Cylinders, in varying strokes and sizes, are used on each V & O Trimmer.



3 Model "R" Foot Valves, adapted to cam operation, actuate each cylinder.

V & O Cartridge Case Trimming Machines—built by The V & O Press Co., Hudson, N. Y. — are a fine example of the application of air power to precision machine movements. Three Model "A" Air Cylinders are used on each machine: —One for gauging and trimming, the second for ejecting the trimmed cases, and the third for stripping scrap metal from the trimming chuck. Each cylinder is controlled by a Model "R" NOPAK Foot-Type Valve actuated by cams accurately synchronized to maintain production at 18 cases per minute.

Inquiries are invited from machine designers, tool engineers and production managers who may be able to use similar applications of air or fluid power to master specific problems of design or production.

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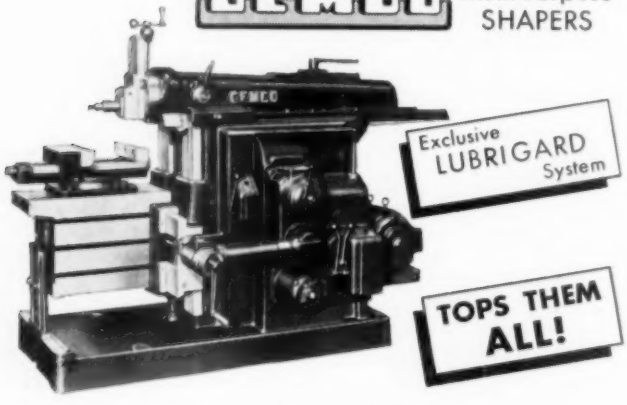

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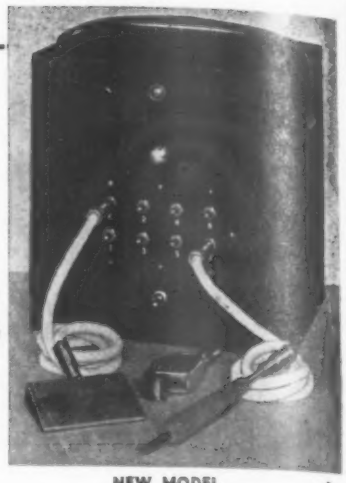

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SLOW SPEED gear motors, .08 to 1140 r.p.m., in 47 sizes from 1/50 to 10 H.P., are described and priced in this 100 page catalog, in such a simplified manner that any one can easily select the correct machine for almost any application.

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SIMPLIFIED INTERNAL GRINDING

with the MAJESTIC INTERNAL GRINDER

An exceptionally wide range of internal grinding jobs can be handled on the New Majestic Internal Grinder. Its simplicity of design and ease of operation are features of utmost importance in providing maximum grinding output at low cost.

SPECIFICATIONS

Length of table, 48". Swing over table, 10". Travel of cross slide, 2½". Precision dial graduated to .0001". Precision bearing work head. Speeds—100, 225, 350 r.p.m.

Write for complete details contained in New Bulletin

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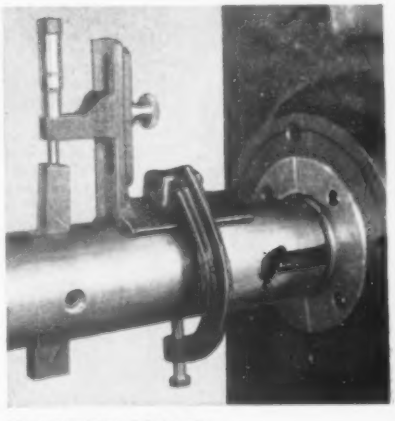
formerly called Bartelt Tool Setting Gage



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As the picture shows, the Bartelt Pedestal Micrometer is clamped* onto a boring bar and the tool set to exact position with the micrometer head. There are two ways of doing this. (1) Take a rough cut, reset the tool to exact finishing size with this gage, and take the finish cut. (2) From the bar diameter, set the tool to exact size with the gage, and do the job in one cut. Either way, you will save a lot of time over the "cut-and-mike" system commonly used.

Many other uses . . .

The clamp is detachable, and the pedestal has both flat and vee surfaces on the base. Thus it can be used for a depth gage, a height gage, for inspection, for machine setups, and many other purposes. Write for our new circular. Also inquire about our Pedestal Indicator.

*Three clamps furnished with gage fit all size boring bars from 1" to 5" diameter.

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THE EVER-CHANGING SCENE IN MASS MANUFACTURING

*T.M. REG. U.S. PAT. OFF.

Bert Conway has been named manufacturing coordinator for The Aviation Corporation of Detroit. With the General Motors Corporation for the past 22 years, Mr. Conway will be in direct charge of production and tooling at all AVCO plants. While with General Motors, he was manager of the Chevrolet plant in Toledo, general master mechanic of the Pontiac plant in Detroit and in recent years was in charge of manufacturing and production testing at the Allison aircraft engine plant in Indianapolis. Previous to his work with General Motors, Mr. Conway was with the Ford Motor Company for eight years.

J. Y. Dahlstrand was recently elected vice-president of Universal Gear Corporation, Indianapolis. For the past five years, **Mr. Dahlstrand** has been chief engineer and director of sales for Universal Gear. He was previously connected in engineering capacities with Murray Iron Works, Allis Chalmers Manufacturing Company and Westinghouse Electric and Manufacturing Company. Concurrent with this announcement was the announcement that **Charles H. Amy** was elected as treasurer of the Universal Gear Corporation.

Dr. Willard Henry Dow, president of The Dow Chemical Company was selected by Columbia University as the Chandler lecturer and medalist for 1943. The citation accompanying the award named Dr. Dow as "one of the outstanding industrialists of the present generation" and noted as particu-

(Continued on page 216))

EDSEL B. FORD

Edsel Bryant Ford, president of the Ford Motor Co., died at his home in Grosse Pointe Shores, Mich., May 26. He was 49 years old.

The only son of the automobile pioneer, he headed the fabulous Ford industrial empire since 1919.

He contributed much to the historic 1927-1928 revamping of Ford plants, when the Model T was discontinued; is credited with the introduction of the V-8 car, the Lincoln Zephyr and Mercury cars.

Sharing much of his father's Christian philosophy—a belief that the land is the foundation of all things good, that America's destiny lies in more, not less production—he was an exponent of industrial cooperation and product improvement.

Edsel Ford worked with his hands. He was a machinist. At the age of 19 he entered the Highland Park plant, graduated from the Trade School and spent five years in the factory.

His death, attributed by physicians to a stomach malady, was hastened by 12 to 16 hours spent daily directing Ford war work.

GET BIG PRODUCTION FROM UNSKILLED WORKERS!
Every dollar invested in
BOICE-CRANE SAFETY-ENGINEERED PRECISION-BUILT SHOP-TESTED **POWER TOOLS**
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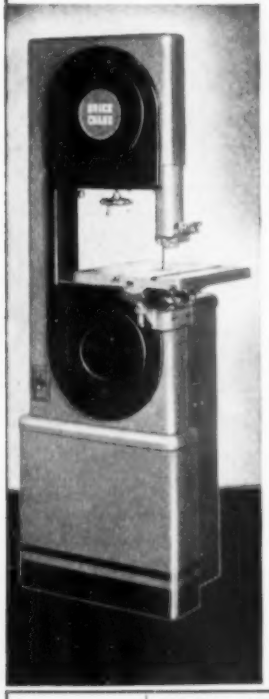

BOICE-CRANE MODEL 2300, 14" SAFE, STEEL CLAD BAND SAW

For cutting metals, wood, plastic and paper. Cuts stock 8⅝" thick and handles 27" diameter work. Accurate blade tension scale.

Entire frame work is a single, one-piece steel structure. Wheels made of strong, light weight materials for exceptionally vibrationless and quiet operation. Wheel guards swing on hinges and must be closed before you can operate machine.

Telescoping blade guard holds by friction when lock handle is released. It will not drop while adjusting.

Tool and die makers will appreciate our new blade guide design. These guides handle blades from ⅛" to ¾" without trouble, and are adjusted by a convenient single knob control.

The table is 15" x 15½" and is rigidly supported on two large trunnions—no portion can sag under heavy cuts. Table tilts 45° to right—10° to left—degree of tilt indicated by convenient scale.

8 speeds . . . one to suit every kind of blade and efficiently saw every kind of material. Heavy duty gears transmit as much as one horse power at lowest speed with a larger margin of safety. All gears run in oil.

On floor model everything including motor is fully enclosed and sealed against dust and grime—no exposed moving parts. Given top rating by State Safety Commissions.

Also available in bench model.

A battery of 6 to 10 Boice-Crane Saws cost no more than some single machines of big size.

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Rapid production. Uses smallest diameter abrasive sleeve of any low priced spindle sander. Sands any degree of bevel up to 6 inches in height. Large, tilting work table.

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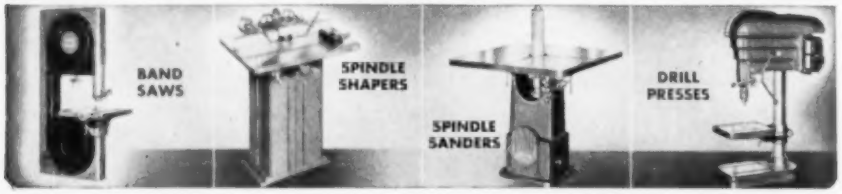

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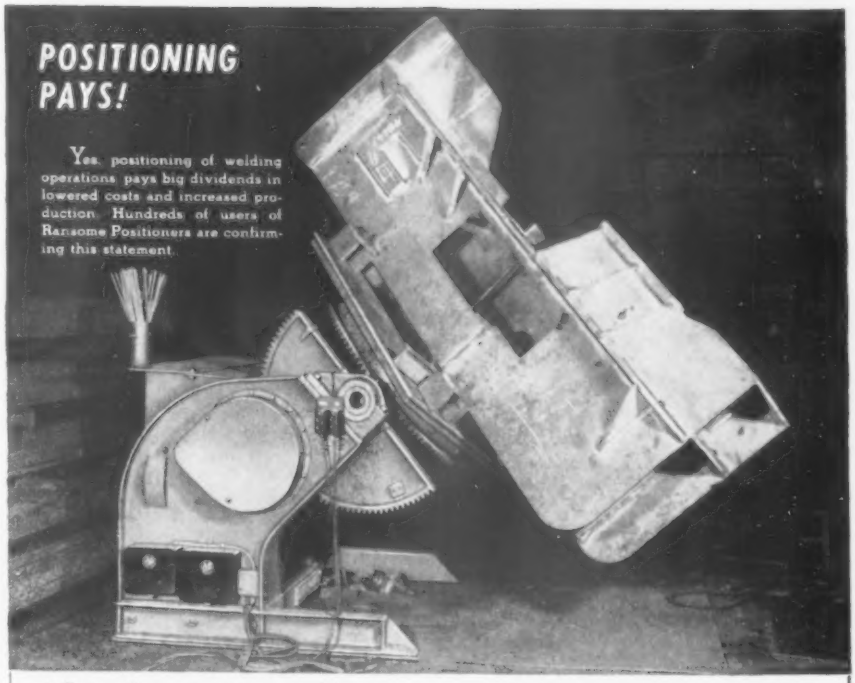

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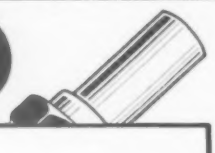
DANLY
PRECISION DIE SETS

Even after LONG USE...



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THERE ARE TWO NEW PLUGS IN
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Reversible PLUG GAGES

Both "Go" and "No Go" Plugs in same handle. Either quickly reversible when worn, bringing new plug into use.

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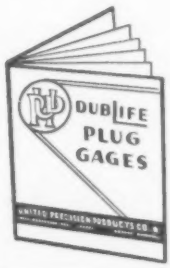

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DUBLIFE, and other Gages of A. G. Design. Complete engineering data. Write or wire

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larly spectacular "the achievements of the company in producing bromine and magnesium from sea water and of synthetic plastics and rubber."

Raymond R. Ridgway, associate director of research for Norton Company of Worcester, Massachusetts, was awarded the Jacob F. Schoellkopf Medal for 1943 at the meeting of the Western New York Section of the American Chemical Society at Niagara Falls, New York on May 20.

Frederick R. Lack was recently elected a vice-president of the Western Electric Company. Resigning as an officer of Western Electric last year, Mr. Lack became director of the Army and Navy Electronics Procurement Agency in Washington. He will now resume the direction of Western Electric's Radio Division in New York.

Adam MacKenzie, vice-president in charge of manufacturing of Carboloy Company, was elected chairman of the Detroit Section, American Institute of Mining and Metallurgical Engineers.

Edgar C. Brandt, in charge of the tools division, WPB Detroit, returned to the Westinghouse Electric & Manufacturing Company May 1.

Leroy Crawshaw recently accepted a position as plant manager of the Lynwood plant of the Western Gear Works. Previous to this new position at Western Gear works, Mr. Crawshaw had been with Westinghouse Electric and Manufacturing Company for 24 years.

M. I. Bradley has been appointed by the LaSalle Finance Corporation and the Investment Corporation of North America as special representative in their different plants. He will be general production engineer in charge of sales and production methods. Mr.

M. I. BRADLEY
Now plant production head.

Bradley was formerly plant manager with Lycoming Division, Aviation Corps at Williamsport, Pennsylvania. Prior to that position he was works manager with Natco, Richmond, Indiana. Mr. Bradley is a member of American Society of Tool Engineers.

Gordon Lefebvre was recently elected president and general manager of the Cooper-Bessemer Corporation. Formerly vice-president and general manager of the company, Mr. Lefebvre succeeded **M. B. B. Williams,** former president of the company, who will continue his duties as chairman of the board.

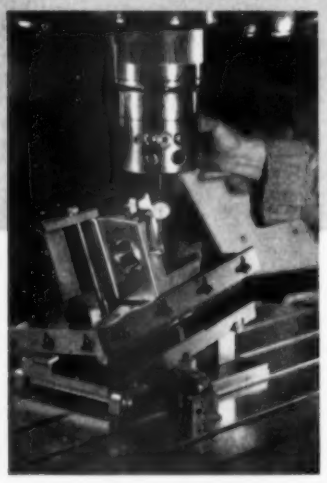
GORDON LEFEBVRE
Now president of Cooper-Bessemer.

G. Donald Spackman was recently elected vice-president in charge of operations of Lukens Steel Company. Formerly general manager of Lukens Steel Company and its subsidiaries, Mr. Spackman in his new position will be responsible for the overall operations of three companies and their coordination for maximum production for the war effort.

John Wolcott Haddock has been elected president of Farrel-Birmingham Company, Inc. Mr. Haddock was formerly vice-president of the Sullivan Machinery Company. He is a member of the American Institute of Mining and Metallurgical Engineers and the Army Ordnance Association.

(Continued on page 218)

QUICK · ACCURATE



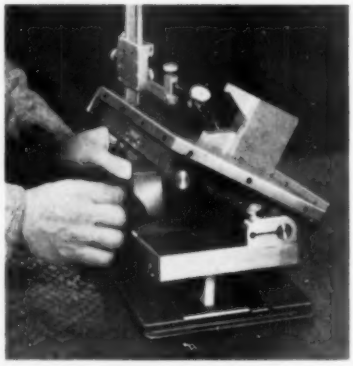
Angular Set-ups for JIG BORING

The fastest and most accurate method of securing angular set-ups for jig boring is by the use of the Robbins Sine-Plate. Standard gage blocks are used to set the plate to either single or compound angles. The work can be quickly attached to the plate with no possibility of slipping or changing positions during the boring operation. The Sine-Plate, being non-magnetic, is not dependent on electric current being available where it is used.

Invaluable For Angular Inspection Work

Manufacturers throughout the world use the Robbins Magna-Sine as the magnetic chuck for angular grinding work and the Sine-Plate for angular inspection purposes. Both products are of the same workmanship and accuracy, and have many of the same standard parts which, if necessary, can be replaced quickly and at low cost.

The Robbins Sine-Plate is supplied in two sizes in both single and compound angle models. Prompt delivery can be assured. Write for full information.



The **ROBBINS SINE - PLATE**

ROBBINS ENGINEERING COMPANY
318 MIDLAND AVENUE • DETROIT, MICHIGAN

M-B SUPER-SPEED Pneumatic GRINDER

Model SS-SR

The only hand grinder with spindle speed of 100,000 R. P. M. on 100 pounds air pressure. It has revolutionized hand grinder performance. Can be directed in any working position; operates with extreme ease. Steel construction throughout. Formed to fit the hand.

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Also Other Models, and Air Line Filters and Automatic Lubricators.

A 100,000 R.P.M. UNIT AMAZING SPEED and POWER

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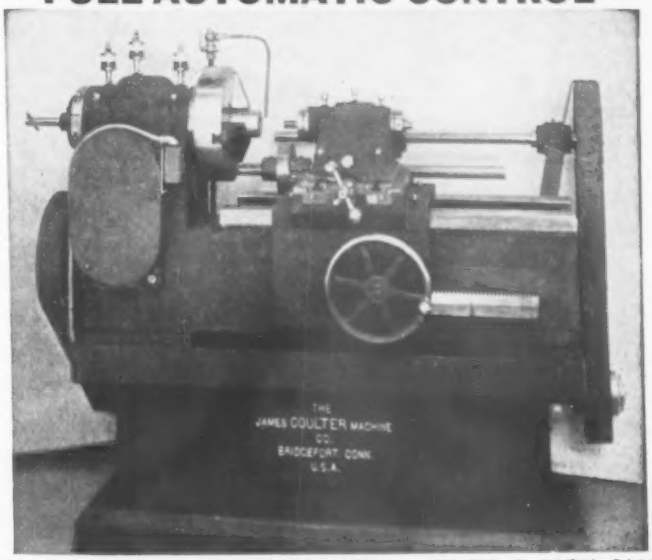

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COMPLETE MOTOR EQUIPMENT — FIXTURE TO SUIT

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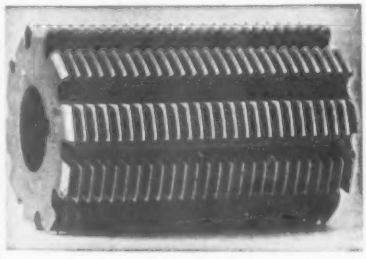
THREAD MILLING HOBS & COMBINATION CUTTERS

Class 1 or 2 or 3 fit in any thread system and thread angle



Shell hobs up to 7" O.D. and 5" width Taper shank hobs to 12" overall length.

On orders more than 25 hobs—1st shipment within ten days.

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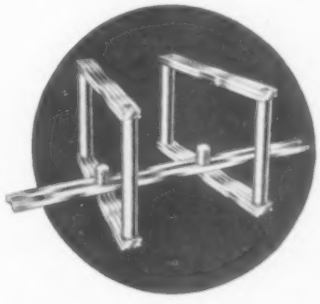
That Speed Precision Operations...!



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Do it the war-time way . . . the safe and speedy way . . . with Acro *adjustable* PARALLELS. They are made in three sizes and handle a wide range of work.

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These modern PARALLELS have become standard equipment in many of America's leading war plants . . . your assurance that PARALLELS by Acro will do much toward speeding precision operations in your plant. Act now!

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The Production Saws of Modern Industry

Racine Metal Cutting Machines are hydraulically fed and controlled for smooth "oil-cushioned" operation.

Racine offers a complete range of cutting pressures in either "positive progressive" feed, or in "self-compensating progressive" feed. Progressive feeding produces a true and natural shearing stroke. Saves blades and permits faster cutting.

Racine's complete line includes models for general purpose and production metal cutting, in a wide range of sizes and prices. Capacities 6" x 6" to 20" x 20".

RACINE *Variable Volume* HYDRAULIC PUMPS

A Modern Source of Hydraulic Force

For bending, feeding, molding, holding, pressing and numerous other operations. Pressures of 50 to 1000 lbs. per sq. in. at 0 to 30 gal. per min. HYDRAULIC VALVES—Sizes ⅜" to 1½", with mechanical, electrical or manual operating devices. Request complete information and prices. Address Dept. TE-S.

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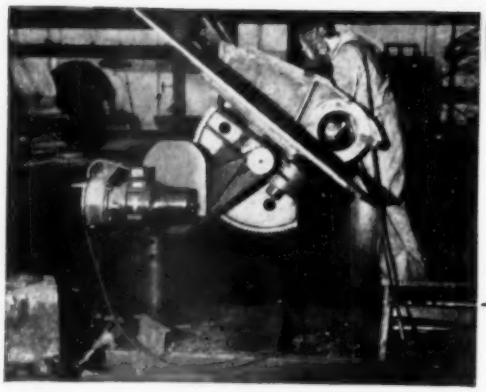
RACINE TOOL AND MACHINE CO.
RACINE, WISCONSIN



C-F POSITIONERS

Speed Production and Job Welding

Write for Bulletin WP 22.

C-F Positioners make welding a faster and more economical operation — save time, save man-hours. The welder himself turns and tilts and positions even the clumsiest and heaviest weldments with a push button control — without cranes, crane crews, hoist, jacks or "flopping" space. All sides can be welded down-hand — all welds can be made faster with heavier rods; made stronger, smoother and flawless.

C-F Positioners come in sizes and types for every welding need — range from small hand operated units for light job work to giant positioners that swing great weldments weighing 30,000 lbs. All have platforms that rotate the full 360° and tilt to 135° beyond horizontal. ***All are adjustable for height and are pedestal mounted to give greatest floor clearance.***

C — F POSITIONER

CULLEN-FRIESTEDT CO.,
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MARSCHKE BUFFERS

at CURTISS - WRIGHT

•Airplane propeller blades are polished with light MARSCHKE Swing Frame Buffers at the Caldwell, N. J. plant of Curtiss-Wright.
•These highly maneuverable machines are as efficient for buffing awkwardly shaped work pieces or flat metal surfaces as are Marschke Swing Grinders for cleaning steel slabs and castings.

SWING FRAME BUFFING is a relatively new practice, but the popularity of this Marschke idea has increased rapidly for a growing variety of applications. They have sufficient weight and power for fast, clean finishing. Suspended from a tram rail or jib crane, they can be manipulated to cover large areas of plane or contoured surfaces. Absence of outboard bearings gives the operator an unobstructed view of his work and makes wheel changes a mere matter of removing the spindle end nut and the wheel flange. Built to meet your needs in 3 to 20 HP., Single and Multiple Speeds, with 12" to 18" buffing wheels. Write for catalog to—

THE MARSCHKE LINE

Manufactured and Sold by the

VONNEGUT MOULDER CORPORATION
1820 Madison Ave., Indianapolis, Ind.

PASSING PARADE

William H. Harman was recently elected president of William Sellers and Company of Philadelphia. Mr. Harman has been associated with The Baldwin Locomotive Works since 1928 and during the last five years has been vice-president in charge of sales for the Baldwin group.

WILLIAM H. HARMAN
Elected president of William Sellers.

J. M. McLeod, formerly assistant sales manager of the Hardinge Brothers plant in Elmira, New York, is now associated with Ray H. Morris as district manager of the Hartford office of Hardinge Brothers, Inc.

J. M. McLEOD
Now at Hardinge Hartford office.

Dr. Frank K. Schoenfeld has been named technical superintendent of the technical division of the B. F. Goodrich Company.

DIED

Fred S. Denison, engineering executive of the Minneapolis Honeywell Regulator Company, died recently in Minneapolis. 56 years old at the time of his death, Mr. Denison was the winner of the National Association of Manufacturers' Pioneer Award in 1940. With the company for 35 years, Mr. Denison was the first member of the engineering department of that company.

Alden M. Hammond, senior partner of the Hammond-Goff Company of Providence, Rhode Island died recently.

W. J. Wooldridge, until recent years head of silicon sheet sales for the Allegheny Ludlum Steel Corporation, died recently at his home near Pittsburgh. One of the pioneer figures in the development of electrical materials, Mr. Wooldridge was 70 years old at the time of his death. At one time he was associated with W. S. Moody of the General Electric Company and was later associated with a number of producers of silicon sheets. THE END.

"Safe-Hed" STEEL STAMPS

IMMEDIATE
SHIPMENT FROM STOCK
ALLOY TOOL STEEL
ALL SIZES
MADE FOR 90% OF MARKING NEEDS

Write for Cat. 146-A!

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for
B & S MACHINES

Cams cut to your layout shipped within 2 to 3 days.

Set of 3 No. 00 Cams including blanks, cutting, heat treating — $6.20 complete. Other sizes in proportion.

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1871 CLYBOURN AVENUE
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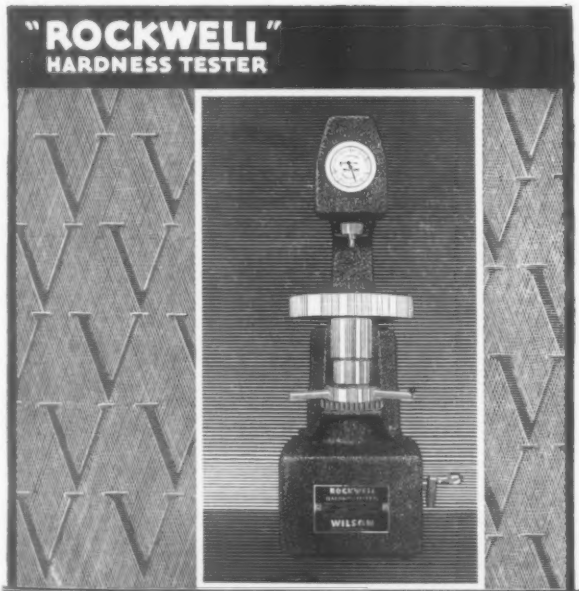
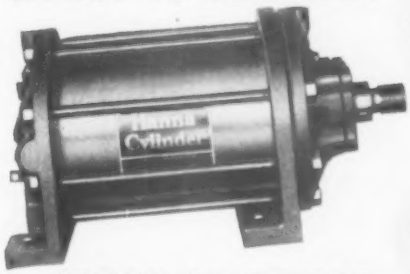
"ROCKWELL"
HARDNESS TESTER



ITS REPUTATION FOR BOTH INITIAL AND ENDURING ACCURACY HAS BEEN GROWING CONSTANTLY FOR A FIFTH OF A CENTURY

WILSON
CONCORD AVE NEW YORK MECHANICAL INSTRUMENT CO. INC.

...TO CUSHION?
OR NOT TO CUSHION?



WHEN IN DOUBT
Specify Cushions
FOR YOUR CYLINDERS!

YES, it is an important question. But, if there is doubt when selecting cylinders for heavy shock loads or high speed . . . play safe . . . specify Hanna *Cushioned* Cylinders. Hanna Cylinders can be equipped with adjustable *pneumatic* cushions at either end or both ends, at nominal cost. Type MC cushion is designed for standard duty. For heavy duty, long-stroke applications, Type SB cushion is recommended. When in doubt, let us help you select the *right cushion* for the job. Write for catalog No. 230.

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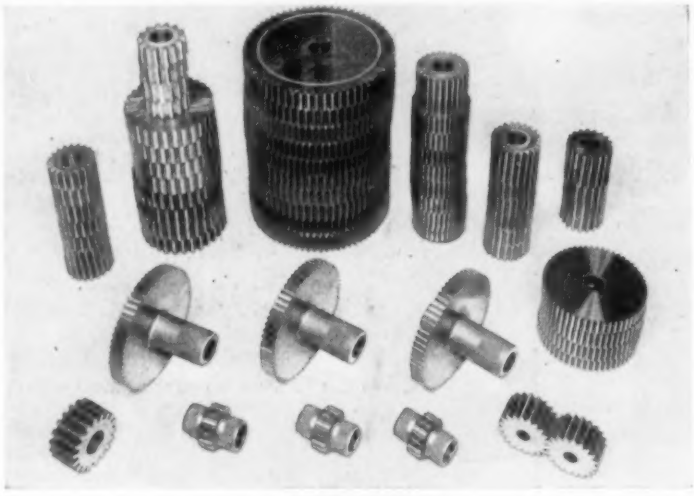
1765 ELSTON AVENUE • CHICAGO, ILLINOIS
RIVETERS • CYLINDERS • AIR HOISTS

INVOLUTE BACKLASH MASTER ROLLING GEARS

Made with AMCO'S precision built Grinding and Checking equipment are unexcelled for accuracy, quality and service.



OUR PRODUCTS

Straight Side, Serration, Involute Male and Female Splined Gages, Plug, Ring, Snap, Flush Pin, Profile, Fixture, Length, Width, Thickness and Relation Gages. We have a complete Spline Engineering Service for your convenience. Gages with close tolerances are normalized and stabilized. All gages are inspected at 68° Fahrenheit. May we quote on your requirements?

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YOUR OPERATIONS WITH MULTIPLE INSTALLATIONS OF GOVRO - NELSON DRILL UNITS

INCREASED-

PRODUCTION RATE
OPERATOR EFFICIENCY
FLOOR SPACE

PROMPT DELIVERIES NOW

HOLE ENGINEERING SERVICE

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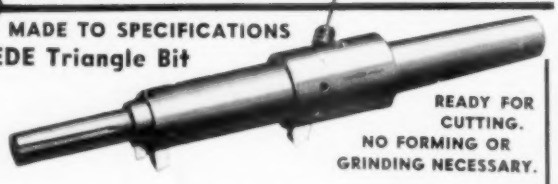
EVEREDE SPECIAL BORING BARS ★

MADE TO SPECIFICATIONS with EVEREDE Triangle Bit

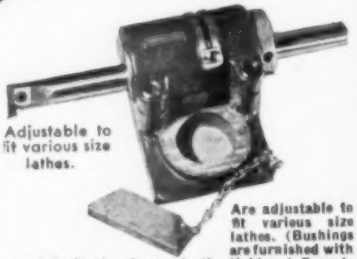
Micrometer adjustment with indicator dial on wrench. Assuring accuracy regardless of bit angle. Furnished with solid bits of Tungsten carbide "Stellite" or High Speed Steel.



READY FOR CUTTING. NO FORMING OR GRINDING NECESSARY.

Write for Folder.

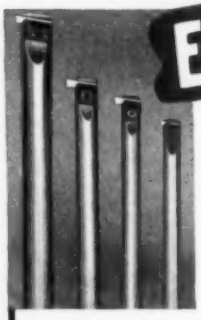
EVEREDE BORING BAR HOLDERS



Adjustable to fit various size lathes.

Are adjustable to fit various size lathes. (Bushings are furnished with each boring bar for use in the Holders.) Everede Holders keep the boring bar in a horizontal position, regardless of any change in the size of the lathe, within limits. • The No. 1 Holder for lathes from 2" swing to 9". • The No. 2 Holder for lathes from 8" swing to 12", and the No. 3 Holder on engine lathes from 12" swing to 24".

EVEREDE BORING BARS



The ONLY Boring Bars with the Economical Triangular Bit.

Made of finest nickel steel, heat treated, uses a H.S. Steel or solid Tungsten bit. Bit cuts ahead of the bar and allows boring of a hole right up to the shoulder. Designed for rigidity and adaptability to all uses. Bars for lathe boring range from 7/12" to 3½". From 7/32" to 6¾" with precision ground shanks for jig boring.

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GARRISON GEAR CHUCKS

are used on—

- GEAR SHAPERS
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and are used for—

Grinding . . . Precision Boring . . . Machining and other operations on Spur . . . Internal . . . Bevel . . . Cluster . . . Helical and Herringbone Gears.

GARRISON

MACHINE WORKS, INC.

DAYTON — OHIO

Special
LIVE CENTER SET-UP REDUCES SCRAP
on vital aircraft engine part

Battery of Ex-Cell-O Thread Grinders Involved in Operation

Operator at N. A. Woodworth Company, Ferndale, Michigan, putting another part on specially designed Sturdimatic Live Center

They had trouble with *dead centers*, during a precision grinding operation at N. A. Woodworth Co., because of deep scratching. Emery, in the coolant, was getting between dead centers and a highly polished spherical radius hole, in the part, that was used for support between centers . . . We designed a special STURDIMATIC LIVE CENTER which, revolving with the part, stopped all movement between the highly polished concentric surface and the center, eliminating the trouble at the source—without any rubbing action, the emery in the coolant had no bad effect . . Scrap had been running high—threads had to be ground concentric with the spherical radius hole within very close tolerances and production of thousands per day had to be maintained. So here a substantial saving on a vital war part was accomplished by using a STURDIMATIC LIVE CENTER . . . standard shanks with Morse taper carried in stock . . . send for a catalog.

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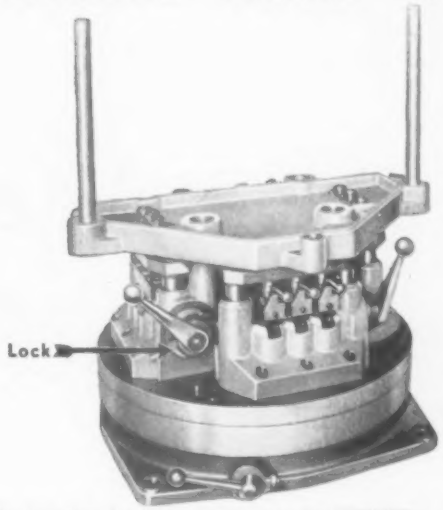
DETROIT, MICHIGAN
LIVE CENTER

SPECIFY SIEWEK
AUTOMATIC FIXTURE LOCKS



Why leading Tool Engineers specify SIEWEK automatic fixture locks:

1. **Drive direct to the job.**
2. **Are a positive lock.**
3. **No back lash.**
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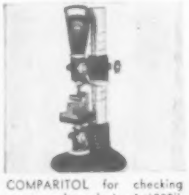
SIEWEK TOOL COMPANY
Ferndale **Michigan**



COMPARITOL for checking gages and work to 1/1000". $195.00

ADJUSTABLE SNAP GAGES for production inspection.

MAGNI-RAY illuminated magnifier for inspection. . . $18.50

SPENCER MICROSCOPES for surface finish, imperfections. $143.50

ULTRA-CHEX—34 gage blocks provide standard of measurements. $125.00

This instrument, at a price within the reach of any shop, is an optical device for measuring or comparing objects by means of a magnified image.

It is used for:

checking tools to eliminate errors at source.
inspecting and measuring pivoted work, screw machine parts, etc.
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controlling tool wear through regular checking of work.
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Easy to operate, simple and sturdy in construction, the Wilder Projector offers many opportunities to speed up measuring, checking and inspecting. Base Price $268.50

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Speed Lathes
SPEED UP PRODUCTION

USED FOR FINAL FINISHING OPERATIONS

ECONOMICAL POLISHING LAPPING, BURRING, BURNISHING, FINISHING

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GEARS
SHAFTS
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BALL RACES
SMALL PARTS
ETC.

Built to meet the requirements of those desiring a heavily constructed, smooth running machine of highest quality.

Has motor in base with variable speed control, using REEVES standard pulley and belt.

Smooth automatic brake acts instantly when switch is thrown. Collets or chuck may be used.

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COLBORNE—THE SPEED LATHE PEOPLE

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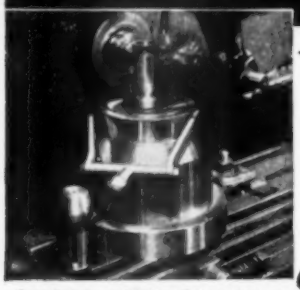
New ZAGAR HORIZONTAL BROACHING MACHINE

. . . shortly to be announced. Meanwhile, *Zagar invites you* to lay your broaching problems before our engineering department.



←Milling spring slots in collet with 2" Zagar Indexing Fixture, indexing 3 times at 120°. Part held very rigid. Set-up extremely simple. Performance trouble-free. Job would run on U.S. hand mill. Production: 54 milled slots per hour when using tool steel.

Zagar Indexing and Holding Fixtures short-cut production, save time and make more money

Ask for our Bulletin "E-6"

COLLETS

In stock — Zagar No. 2 and No. 6 Collets, similar to W. & S. No. 2 and No. 6 Collets.

ZAGAR TOOL, INC.

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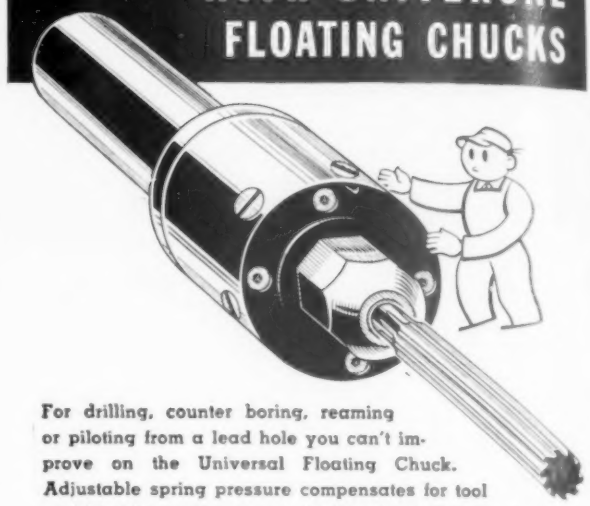

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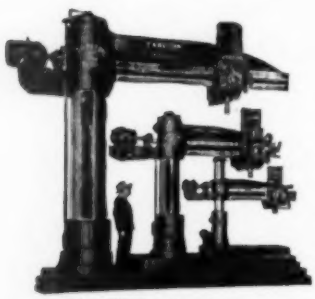

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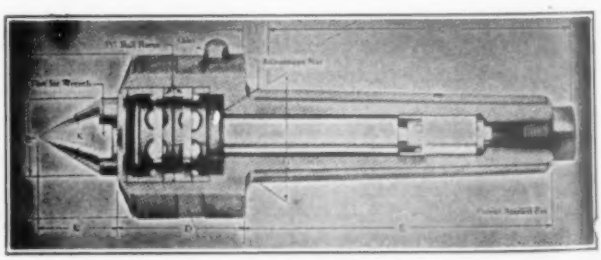

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Left: Set-up for tapping deep impression Die. Below: Set-up for cutting an internal gear.

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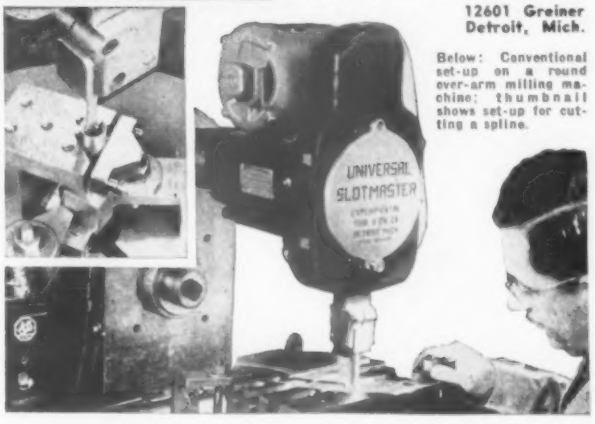

Below: Conventional set-up on a round over-arm milling machine; thumbnail shows set-up for cutting a spline.

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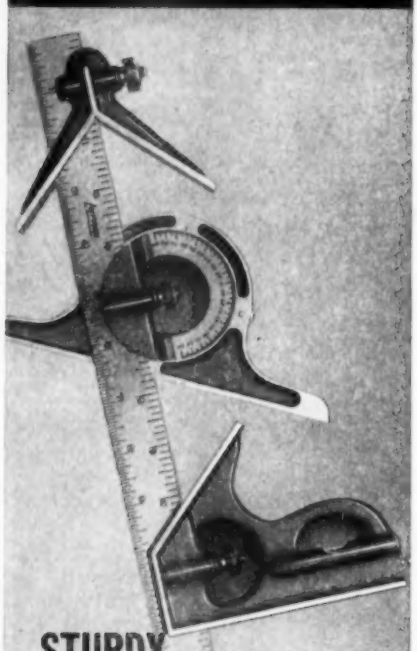

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Advertisers Appearing In This Issue

Acme Industrial Company 211
Acro Tool & Die Works 217
Aero Tool Company 30
Ajax Steel & Forge Company 213
Alco Tool Company, The 156
Allegheny Ludlum Steel Corp. 51
Amco Gage Company 220
American Cutter & Engineering Corp. 207
American Swiss File & Tool Co. 112
Ames Company, B. C. 154
Ampco Metal, Inc. 194
Apex Machine & Tool Co., The 175
Armstrong-Blum Mfg. Co. 160
Armstrong Bros. Tool Company 223
Aro Equipment Corp. 48
Arter Grinding Machine Co. 182

Baker Bros., Inc. 122
Baldor Electric Company 224
Barber-Colman Co. 58
Barnes Corp., John S. 158
Barnes Co., W. F. & John 140
Barnes Drill Co. 165
Barnes Co., Inc., W. O. 157
Bartelt Engineering Co. 213
Besly & Co., Charles H. 153
Black Drill Co. 124
Blake Company, Edward 203
Blanchard Machine Co., The 6
Boice-Crane Co. 214
Boyar Schultz Corp. 201
Bradford Machine Tool Co., The 178
Brewster-Squires Co. 212
Brown & Sharpe Mfg. Co. 192
Bryant Chucking Grinder Co. 19
Buhr Machine Tool Co. 192

Carbide Fabricators Co. 151
Carboloy Co., Inc. 35
Carborundum Co., The 21
Carlton Machine Tool Co., The 222
Carpenter Steel Co., The 189
Cerro de Pasco Copper Corp. 207
Chambersburg Engineering Co. 197
Chicago Rawhide Mfg. Co. 209
Chicago Wheel & Mfg. Co. 107
Cincinnati Milling Machine Co., The 120
Cincinnati Shaper Co., The 125
Circular Tool Co., Inc. 136
City Engineering Co., The 23
Cleveland Automatic Machine Co., The 113
Cleveland Tool Engineering Co. 108
Cleveland Twist Drill Co., The 145
Climax Molybdenum Co. 131
Colborne Mfg. Co. 221
Colonial Broach Co. 167
Columbia Tool Steel Co. 209
Conn Automatic Machine Co., Inc. 32
Continental Machines, Inc. 119
Copperweld Steel Co. 4
Cortland Grinding Wheels Corp. 181
Coulter Machine Co., The James 217
Cullen-Friestedt Co. 218
Cullman Wheel Co. 158
Cunningham Co., M. E. 224
Cushman Chuck Co., The 208

Dalzen Tool & Mfg. Co. 127
Danly Machine Specialties, Inc. 215
Davis Boring Tool Div. 25
Delta Mfg. Co., The 59
Detroit Broach Co. 114
Detroit Die Set Corp. 206
Detterbeck Co., Geo. L. 219
Diamond Tool Co., Not Inc. 138
Douglas Machinery Co., Inc. 158
Dumore Co., The 184

Eclipse Counterbore Co. 18
Egyptian Lacquer Mfg. Co., The 147
Ettco Tool Co., The 156
Ex-Cell-O Corp. 29
Experimental Tool & Die Co. 225

Federal Products Corp. 109
Federal Tool Corp. 209
Firth-Sterling Steel Co. 13
Fitchburg Grinding Machine Corp. 54
Fray Machine Tool Co. 169

Galland-Henning Mfg. Co. 210
Gallmeyer & Livingston Co. 142
Gammons-Hoaglund Co., The 211
Gardner Machine Co. 166
Garrison Machine Works, Inc. 220
General Engineering & Mfg. Co. 212
Genesee Tool Co. 132
Giddings & Lewis Machine Tool Co. 12
Giern & Anholtt Tool Co. 215
Gilmore & Co., F. F. 202
Gisholt Machine Co. 11
Glenzer Co., The J. C. 225
Gorton Machine Co., Geo. 55
Grand Specialties Co. 225
Gray-Mills Co. 116
Greenfield Tap & Die Corp. 66
Grob Bros. 146
Gulf Oil Corp. 45

Hammond Machinery Builders, Inc. 160
Hanna Engineering Works 219
Hannifin Mfg. Co. 64
Hardinge Bros., Inc. 49
Hartford Chrome Corp. 177
Hartford Special Machinery Co., The 205
Haskins Co., R. G. 209
Haynes Stellite Co. 63
Heald Machine Company, The 10
Hecker, A. W. 104
Hobart Bros., Co. 148
Hole Engineering Service 220
Holo-Krome Screw Corp. 2
Hydraulic Press Mfg. Co., The 33

Illinois Tool Works 52
International Machine Tool Corp., Libby Division 36
International Nickel Co., Inc., The 137

Janette Mfg. Co. 213
Jarvis Co., The Chas. L. 7
Jones & Lamson Machine Co. 15
Junkin Safety Appliance Co., Inc. 142

Kearney & Trecker Prod., Corp. 5
Kent-Owens Machine Co. 193
Knight Machinery Co., W. B. 180
Koebel Diamond Tool Co. 144

Landis Machine Co. 223
Landis Tool Co. 223
LaSalle Designing Co. 178
Latrobe Electric Steel Co. 124
Leach Machinery Co., H. 128
LeBlond Machine Tool Co., The R. K. 223
LeMaire Tool & Mfg. Co. ..... 4th Cover
Lewthwaite Machine Co., T. H. 155
Liberty Tool & Gage Works, Inc. 224
Lima Electric Motor Co., The 175
Lincoln Park Tool & Gage Co. 207
Lipe-Rollway Corp. 226
Ledge & Shipley Machine Tool Co. 34
Logan Engineering Co. 125
Logansport Machine, Inc. 36
Lovejoy Tool Co., Inc. 14
Lufkin Rule Co., The 226

Machine Products Corp. 118
Macklin Co. 4
Majestic Tool & Mfg. Co. 213
Martindale Electric Co., The 205
Masonite Corp. 143
Master Chrome Service, Inc. 184
Matthews & Co., Jas. H. 174
McCrosky Tool Corp. 176
McGowan Engineering Service 174
McKenna Metals Co. 156
McKinney Tool & Mfg. Co. 148
M. B. Products 217
Metal Carbides Corp. 212
Micromatic Hone Corp. 8
Midwest Tool & Mfg. Co. 177
Mohr Lino-Saw Co. 158
Moline Tool Co. 209
Monarch Machine Tool Co., The 40
Monarch Steel Co. 126
Moore Special Tool Co., Inc. 33
Motor Prod. Deepfreeze Division 6
Muehlhausen Spring Corp. 168

National Acme Co., The 117
National Tool Salvage Co. 146
National Twist Drill & Tool Co. 17
New Britain-Gridley Machine Div. ..... Front Cover
Nielsen, Inc. 222

Ohio Units Manufacturers 159
OK Tool Co., The 132
O'Neil-Irwin Mfg. Co. 144
Oster Mfg. Co., The 17
Ott Machinery Sales, Inc. 224

Parker-Kalon Corp. 22
Pioneer Eng. and Mfg. Co. 140
Pipe Machinery Co., The 42
Plan-O-Mill Corp. 134
Porter-Cable Machine Co. 20
Potter & Johnston Machine Co., The 39
Pratt & Whitney Div. ..... 2nd Cover
Procunier Safety Chuck Co. 225
Producto Machine Co., The 196
Putnam Tool Co. 162
Pyott Foundry & Machine Co. 195

Quality Tool & Die Co. 198
Racine Tool & Machine Co. 217
Ransome Machinery Co. 141
Ready Tool Co., The 207
Reliance Electric & Engineering Co. 47
Rivett Lathe & Grinder, Inc. ..... 3rd Cover
Robbins Engineering Company 214
Roberts Rubber Co., Weldon 28
Rotor Tool Co., The 28
Ruthman Machinery Co., The 208

Safety Grinding Wheel & Machine Co., The 187
Sav-Way Industries 63
Schauer Machine Co. 221
Scherr Co., Inc., Geo. 223
Scully-Jones & Co. 1
Sellers & Co., Inc., William 211
Seneca Falls Machine Co., The 34
Severance Tool Industries, Inc. 37
Sheffield Corp., The 161
Sheldon Machine Co., Inc. 203
Sidney Machine Tool Co., The 161
Siewek Tool Co. 223
Simmons-Machine Tool Corp. 8
Skilsaw, Inc. 196
Smit & Sons, J. K. 190
Snyder Tool & Engineering Co. 191
South Bend Lathe Works 50
Standard Gage Co., Inc. 31
Standard Oil Co. (Indiana) 43
Starrett Co., The L. S. 160
Stokerunit Corp. 159
Stuart Oil Co., Ltd., D. A. 201
Sturdimatic Tool Co. 221
Sturtevant Co., P. A. 203
Stutson Associates, Willis 220
Sundstrand Machine Tool Co. 133
Sunnen Products Co. 60
Super Tool Co. 136
Swartz Tool Prod. Co., Inc. 165
Swedish Gage Co. of America 118

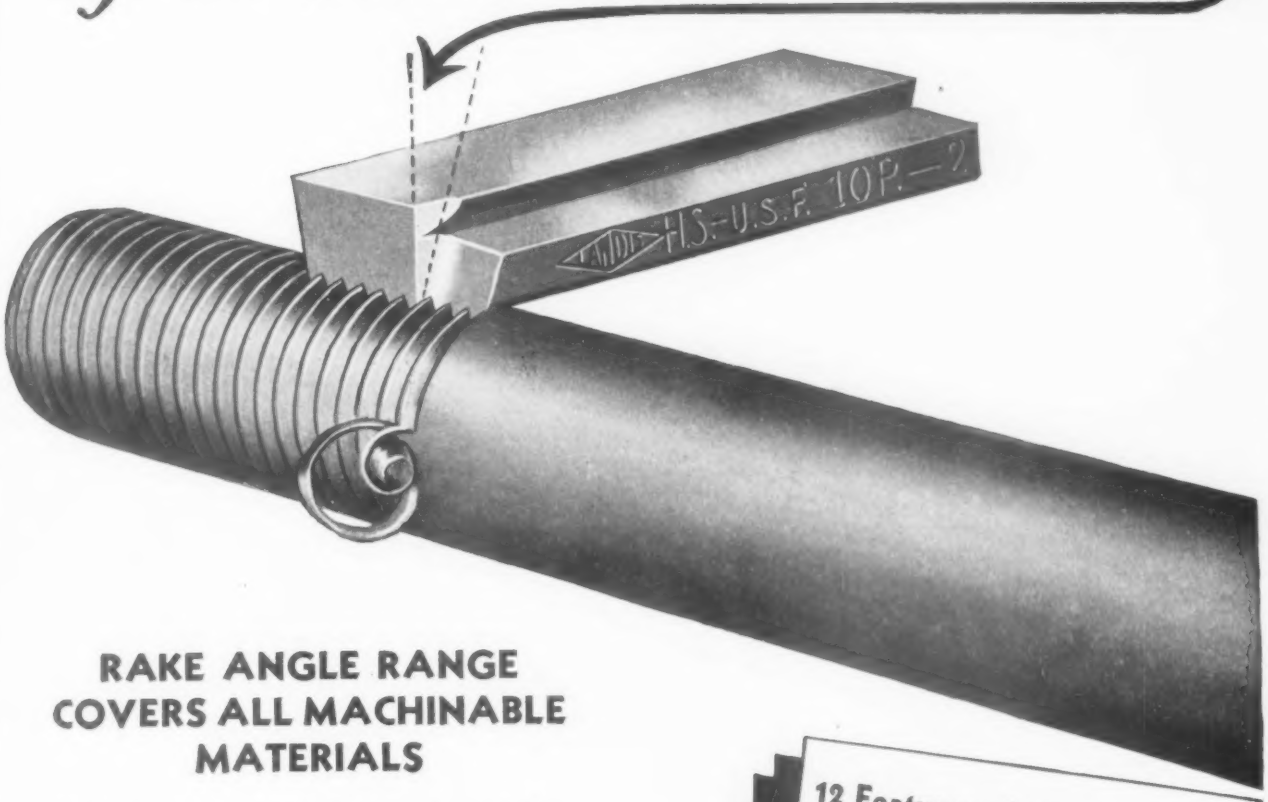
Taft-Peirce Mfg. Co., The 14
Tannewitz Works, The 170
Threadwell Tap & Die Co. 182
Tungsten Alloy Mfg. Co. 204
Tungsten Electric Corp. 183
Turner Uni-Drive Co., The 183
Tuthill Pump Co. 212

Union Carbide and Carbon Corp. 61
United Precision Prod. Co. 215
United States Drill Head Co. 144
U. S. Machine Tool Mfg. Corp. 217
Universal Engineering Co. 205, 222
Universal Vise & Tool Co. 30
Universal Wheel & Abrasive Corp. 119

Van Norman Machine Tool Co. 37
Vascoloy-Ramet Corp. 38
Vince Corp. 24
Vonnegut Moulder Corp. 218

Wales-Strippit Corp. 198
Warner & Swasey 99
Welding Equipment & Supply Co. 142
Wells Mfg. Corp. 144
Wesson Company 179
Wheel Trueing Tool Co. 134
Willey's Carbide Tool Co. 221
Wilson Mechanical Instrument Co., Inc. 219
Winter Bros. Co. 26
Yoder Co., The 40
Zagar Tool, Inc. 222
Ziegler Tool Co., W. M. 132

With the **LANDIS** *Chaser – Thread Quality is Assured by the Variable* **RAKE ANGLE**



RAKE ANGLE RANGE COVERS ALL MACHINABLE MATERIALS

The rake of the Landis chaser is variable, ranging from 5° negative to 35° positive.

This variable rake permits the use of the suitable cutting angle for each machinable material and assures the production of cleanly cut and correctly formed threads.

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1–Permanent throat permits close to shoulder threading throughout life of chasers
2–Rake angle range covers all machinable materials
3–Free cutting condition permits maximum cutting speeds
4–Simple grinding operation renews entire cutting edge and leading feature
5–Line contact with work lessens friction and minimizes thread distortion
6–Leading feature insures thread of accurate lead
7–Lateral absorption of cutting strain reduces vibration and chaser breakage
8–Right and lefthand threading feature reduces chaser equipment
9–Standard chasers thread all diameters with proper chaser holders
10–Interchangeability of chasers lowers operating cost
11–Chaser length provides exceptionally long life and low tool cost
12–Permanent throat gives equal distribution of cut

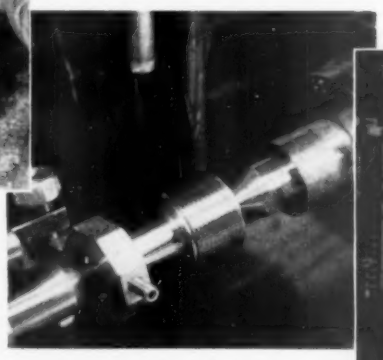
LANDIS
MACHINE COMPANY
WAYNESBORO, PA., U.S.A.

HOW GAGES ARE *Salvaged by Hard Chrome Plating*

1. *When gages are received they are carefully inspected. Those which are in such condition that they cannot be salvaged successfully are rejected.*

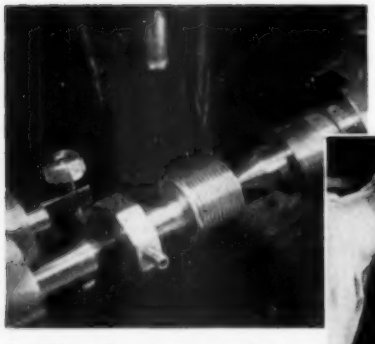
When worn steel gages are salvaged by chrome plating in the Lincoln Park plant, every step is taken to insure the most successful results. Illustrated are some of the various operations . . . all completed and carefully controlled by the Lincoln Park organization.

2. *All strains in gages are removed by drawing in salt bath for several hours.*



3. *Gage is ground undersize.*

4. *Foil and stop-off lacquer are applied in preparation for plating, the parts are properly racked and submerged in the plating bath. The plating operation is controlled by precision instruments in Lincoln Park's modern hard chrome plating department.*



5. *Threads are ground to specified pitch diameter and tolerance. The finest, most modern thread grinding machines are employed for this work.*

6. *All thread gages are properly checked for size, form and lead with close tolerance measuring equipment and accessories which are checked and calibrated in the Lincoln Park laboratory.*

7. *In inspection use, gages salvaged by Lincoln Park provide approximately five times the service life of ordinary gages.*

While a thread gage is illustrated throughout this sequence of operations, similar processes apply to all types of gages salvaged by Lincoln Park.

ARMY (E) NAVY

LINCOLN PARK TOOL and GAGE CO.

LINCOLN PARK, MICHIGAN

RIVETT

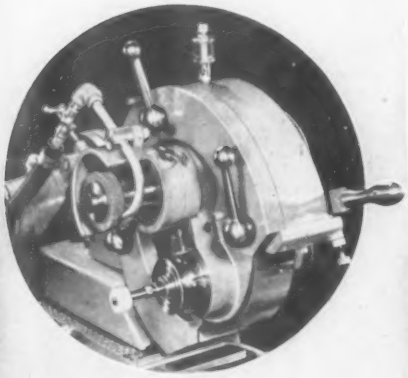
104 INT.-EXT. GRINDER

For Small Hole, Cylindrical and Concentric Grinding

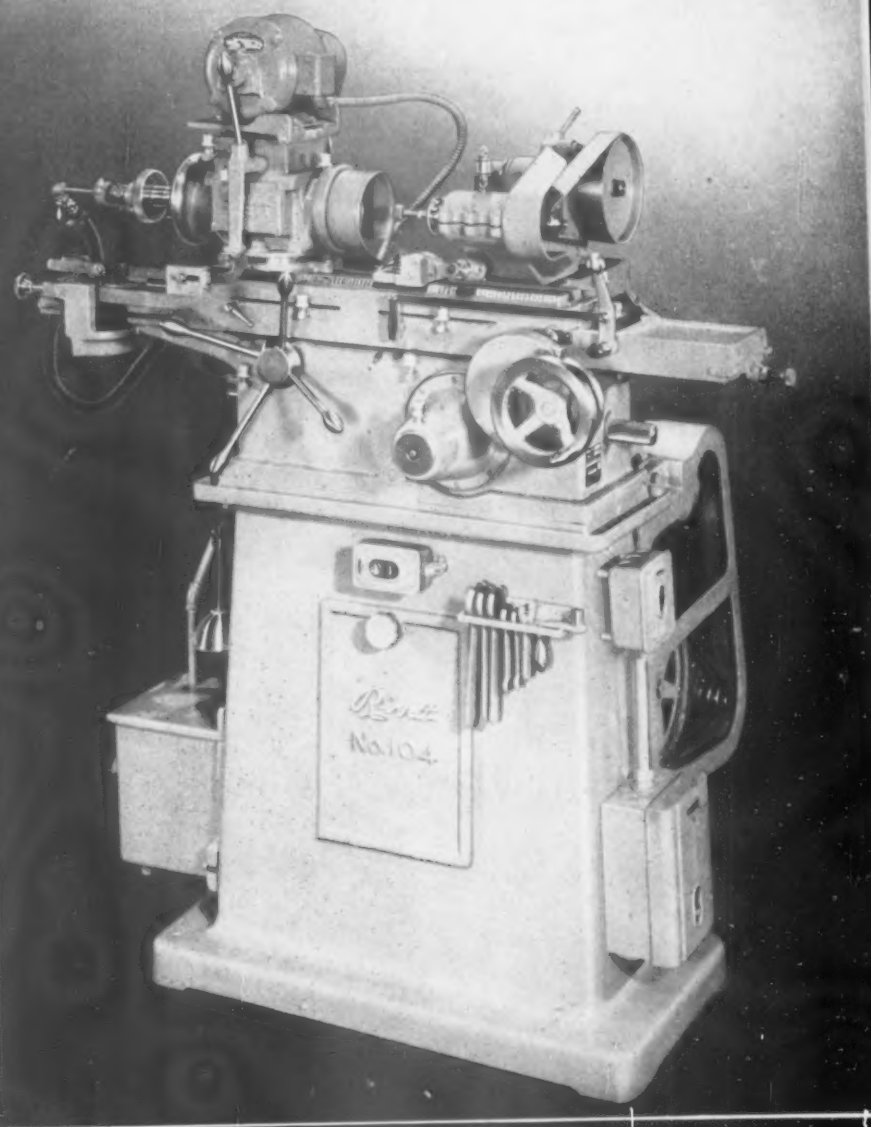
The Rivett No. 104 is a simple, accurate grinder suitable for die and tool making as well as precision manufacturing. Its ease of set-up and operation and its selective spindles make it an efficient machine for internal and external grinding. The internal or external grinding spindle bracket may be selectively mounted on cross slide as desired. For special work requiring concentric grinding of internal and external surfaces at one chucking, turret carrying both internal and external spindles may be used.

Work may be held in collet, step chuck, jaw chuck or fixture or on centers when using external spindle with tailstock. Power table reciprocation has three speeds from 54 to 126 passes per minute. Length of table travel is infinitely adjustable between ¼" and 2" or ½" and 4" depending on range selected.

External Spindle and Tailstock



Internal and External Spindles in Turret



SPECIFICATIONS

Grinding cap., hole dia.	up to 3"
Grinding cap., outside dia.	up to 3"
Automatic table travel	
Standard	¼" to 2"
Special	½" to 4"
Hand table travel	11"
Swing over table	8"
Center distance	8"
Workhead swivel	90°
Table swivel	5°
Cross feed graduations	
Standard	.0005"
Special	.0001"
Travel of cross slide	1¾"
Collet capacity	⅞"
Step chuck capacity	6"
Jaw chuck capacity	6"
Workhead spindle speeds	200, 375, 600 r.p.m.
Grinding spindle speeds:	
Standard int.	21000 and 25000 r.p.m.
External	3800 r.p.m.
Net weight with motors	1750 lbs.

For Further Description Write for Bulletin 104

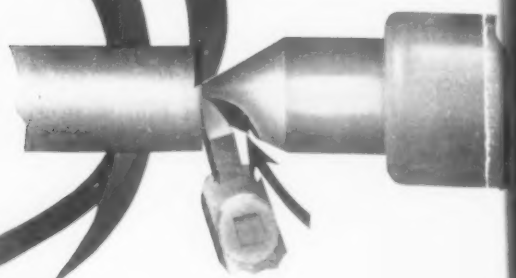
RIVETT LATHE & GRINDER INC.
BRIGHTON, BOSTON, MASS.

I'm tellin' you!

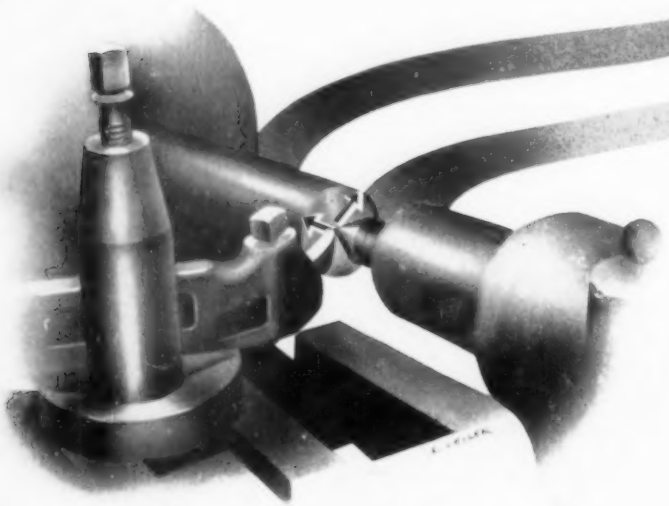
No. 8 in a Series of Tips on "Keeping 'em Turning" by Frank Morris, 42 yrs. at LeBlond

FACING TO LENGTH

Since facing is one of the most common lathe operations, most lathe hands figure they know all there is to know about it. It's not particularly difficult, but I've seen some good men go wrong on these points.



1. You'll save lots of time and effort if you'll keep handy an extra tailstock center that has been grooved or flat ground on the taper. This makes special tools unnecessary because it leaves room for a standard shape tool between work and center. Caution: Be sure flat surface is less than half way through point or it will act as a reamer.



2. For the finishing skim cut, *work from the inside out.* In other words, you start with tool point at the center hole and cut toward outside diameter of the piece with tool edge at slight angle with end of work.

3. Should chatter marks appear on the work, it is because work is running too fast, feed is too great, or angle of tool is too slight. All of these are easily corrected.

THE R. K. LeBLOND MACHINE TOOL CO.

CINCINNATI, OHIO

Largest Manufacturer of a Complete Line of Lathes